Pennsylvania Department of Environmental Protection

Rachel Carson State Office Building
P.O. Box 2063
Harrisburg, PA 17105-2063

April 30, 1998

The Secretary 717-787-2814

Ms. Judy Katz, Director
Air, Radiation and Toxics Division
US Environmental Protection Agency
841 Chestnut Building
Philadelphia, PA 19103

Dear Judy:

Enclosed for your approval are revisions to the Pennsylvania State Implementation Plan for the Philadelphia Ozone Nonattainment Area which comprises the Phase II plan described in the March 2, 1995 memorandum from EPA Assistant Administrator Mary Nichols.

These SIP revisions meet two requirements under Section 182 of the Clean Air Act:

- rate-of-progress demonstrations for the 2002 and 2005 milestone years; and
- the attainment demonstration.

As you know, the Commonwealth's Phase I plan, which contains the rate-of-progress demonstration for 1999, will be submitted to the Environmental Quality Board (EQB) at its July 21 meeting. DEP will submit the final Phase I plan shortly after that review.

Should you have questions regarding this submittal, contact James M. Salvaggio, Director, Bureau of Air Quality, at 717-772-4978.

Sincerely,

James Seif
Secretary

Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 2063
Harrisburg, PA 17105-2063

June 5, 1998

The Secretary 717-787-2814

RECEIVED
JUN 9 1998
Air Protection Division (3AP21)

Ms. Judy Katz
U.S. EPA Region III
841 Chestnut Building
Philadelphia, PA 19107

Dear Judy:

I am enclosing material which fulfills the fourth condition placed upon the interim conditional approval of the 15 Percent Plan for the Philadelphia Ozone Nonattainment Area, as described in the June 9, 1997, final rulemaking. The condition required Pennsylvania to remodel the I/M program as implemented in the Philadelphia nonattainment area in accordance with EPA guidance (December 23, 1996, memo entitled "Modeling 15% VOC Reductions from I/M in 1999—Supplemental Guidance).

If you have questions about this submittal, please contact Arleen Shulman in DEP's Bureau of Air Quality, at 717-787-4310.

Sincerely,

James M. Seif
Secretary

Enclosures

REMODELING OF THE I/M PROGRAM IN THE PHILADELPHIA NONATTAINMENT AREA

As a condition placed upon approval of its 15 percent plan, Pennsylvania was required to remodel the I/M program as implemented in the Philadelphia nonattainment area in accordance with EPA guidance (December 23, 1996 memo entitled ``Modeling 15% VOC Reductions from I/M in 1999--Supplemental Guidance). This remodeling assumes the characteristics of the program that will be in place in July 1999.

With this recalculation, Pennsylvania hereby demonstrates that the controlled emissions are at or under the required target level.

The following summary information follows the steps described in the guidance. Supporting highway inventory documentation is attached. Inventory information from sources other than highway vehicles is consistent with the 15% plan.

1. 1990 adjusted base year inventory for 1996.

CATEGORY	TONS PER DAY
Highway Vehicles	155.87
Point Sources	152.75
Area Sources	194.35
Nonroad Sources	80.56
TOTAL	582.53

2. 1990 adjusted base year inventory for 1999.

CATEGORY	TONS PER DAY
Highway Vehicles	148.45
Point Sources	152.75
Area Sources	194.35
Nonroad Sources	80.56
TOTAL	576.11

3. Noncreditable fleet turnover.

Adjusted base year ('96) - Adjusted base year ('99) = noncreditable fleet turnover between 1996 and 1999

582.53 - 576.11 = 7.42 tons per day

4. The 1996 target level

Adjusted base year ('96) x 85% = 1996 target level

(582.53 x 0.85) - 0.84 (RACT Fix-ups)* = 494.31 tons per day

* EPA guidance for 15% plans requires RACT Fix-ups to be subtracted.

5. The corrected 1996 target level

1996 target level - noncreditable fleet turnover = corrected 1996 target level

494.31 - 7.42 = 486.89 tons per day

6. Projected 1996 emissions inventory (as remodeled)

CATEGORY	TONS PER DAY
Highway Vehicles	84.58
Point Sources	151.15
Area Sources	153.98
Nonroad Sources	81.33
TOTAL	476.53

7. Comparison between adjusted 1996 target level and projected 1996 inventory

Target Level (from #5) = 486.89
1996 Inventory (from #6) = 476.53

Since the remodeled projected 1996 inventory is less than the recalculated target level, Pennsylvania demonstrates that it fulfills its obligation to reduce emissions by 15%.

Re-Modeling of the 15% Rate of Progress Plan for the Philadelphia Severe Nonattainment Area

State Implementation Plan Revision

Philadelphia 5-County Area:

Bucks County
Chester County
Delaware County
Montgomery County
Philadelphia County

Prepared By

Pennsylvania Department of Transportation
And
Michael Baker Jr, Inc.

In co-operation with
Garmen Associates

For
Pennsylvania Department of Environmental Protection
Bureau of Air Quality Control

June 1998

Philadelphia 15% Plan Re-modeling
Pennsylvania's PA97 with ASM I/M Program

The Philadelphia 15% Plan re-modeling methodology is based on the EPA Supplemental Guidance of Modeling 15% VOC Reductions from I/M in 1999, dated December 23, 1996.

The modeling demonstration was performed using EPA's MOBILE model version MOBILE5a_H for calculating emission factors and the Post Processor for Air Quality Analysis (PPAQ). PPAQ provides a set of programs that analyzes network operating conditions, calculates highway speed segments, compiles VMT and vehicle mix data, prepares the MOBILE runs, and calculates quantities from the emissions rates and VMT.

Scenarios

The Philadelphia 15% plan re-calculation requires five scenarios based on the supplemental guidance. A description of each scenario with the appropriate emission rates and VMT are provided in the following table:

Scenario	Emission Rates	VMT
1990 Actual	1990	1990
1990 Adjusted to 1996	1996	1990
1990 Adjusted to 1999	1999	1990
1996 Uncontrolled Baseline	1999	1996
1996 Control Strategy	1999	1996

Modeling Inputs and VMT Forecasts

The MOBILE input parameters for each scenario are enclosed in the appendices. Specific key input parameters that may require greater clarity are provided below.

- All modeling scenarios were performed with MOBILE model version MOBILE5a_H.
- An evaluation date of July 1999 was used for the I/M program re-calculation of the 15% plan.
- At the time of evaluation, the PA97 w/ ASM I/M program will be utilizing ASM5015 final cutpoints (50.0/15.0/1.00). These cutpoints were used for the control strategy scenario.
- To model an ASM program with MOBILE5aH, the test type in the I/M descriptive record

must be set to "3" (loaded/idle test) and the corresponding cutpoints (50.0/15.0/1.00) reflect the ASM 5015 program.

- EPA's latest I/M credit data files were used for all scenarios. TECH12.D for Tech I & II vehicles and IMDATA4.D for Tech IV+ vehicles.

- The vehicle age distribution reflects July 1993 conditions as provided by PennDOT Bureau of Motor Vehicles, consistent with Pennsylvania's Rate of Progress SIPs.

- The program type in the I/M descriptive record is set to "1" (test only) to account for the 100% program effectiveness of the decentralized test and repair PA97 w/ ASM I/M Program.

- Vehicles 1981 and newer receive the full EPA pressure test and vehicles 1975 to 1980 receive the gas cap pressure test.

- Vehicle Miles Traveled (VMT) forecasts are based on 1992 Roadway Management System traffic volumes and growth rates provided by PennDOT Bureau of Transportation System Performance (BTPS), consistent with Pennsylvania's Rate of Progress SIPs.

- Seasonal adjustment factors are applied to the average annual daily traffic (AADT) to produce typical summer day average weekday traffic (AWDT) volumes. The seasonal adjustment factors are prepared by PennDOT Bureau of Planning and Research.

Philadelphia 5-County Area 15% Plan MOBILE Modeling Results

The results of the Philadelphia 5-County Area 15% Plan Recalculation for the highway inventory are presented in the following sections.

1. Philadelphia 5-County Area MOBILE Input Parameters

2. Summary VMT, VOC and NOx Inventory and Forecast by County

3. Control Strategy Emissions Component Breakdown

4. VMT, VOC and NOx Inventory and Forecast by Functional Class

5. VMT, VOC, CO and NOx Inventory and Forecast by Vehicle Type

6. Philadelphia 5-County Area MOBILE5a_H Input Files

Philadelphia Area Modeling Methodology

The modeling demonstration for the Philadelphia area is performed with two scenarios to account for the gas cap pressure check given to vehicle model years 1975 to 1980. This methodology is consistent with that used in the 2/27/98 I/M SIP remodeling. Vehicle model years 1981 and newer receive the full EPA pressure test. The gas cap pressure check cannot be modeled directly with MOBILE, but receives 40% credit of the EPA pressure check. The credit for the gas cap check is interpolated from the difference of the two scenarios.

The first scenario is modeled with two I/M programs (one for the idle test for pre-81 model years and the second with ASM for model years 1981 and newer), anti-tampering (1975 and newer), EPA pressure and purge (1981 and newer). In the second scenario, the first model year of the EPA pressure test is changed to 1975 to reflect a pressure test for 1975 and newer vehicles. The difference between the two scenarios accounts for the full pressure credit for 1975 and 1980 vehicles. Therefore, to receive credit for the gas cap pressure check, the resultant emissions are interpolated with 40% of this credit by using the following equation.

Total EM = Scenario 1 (w/o gas cap) - [(Scenario 1 - Scenario 2 (w/ gas cap) x 40%]

EM = Emissions (tons/day)

Control Strategy Breakdown

The control strategy breakdown estimates the emissions reduction for the PA97 with ASM I/M program, federal reformulated gasoline (RFG) and federal motor vehicle control program (FMVCP). The breakdown was modeled in four scenarios and the estimated credit determined as the difference between scenarios. The scenarios were modeled as follows:

Scenario 1:	1996 Uncontrolled Baseline
Scenario 2:	Scenario 1 + ***PA97 w/ ASM I/M***
Scenario 3:	Scenario 2 + ***RFG***
Scenario 4:	Scenario 3 + ***FMVCP***

310—521 REV. 12-88

PUBLICATIONS AUTHORIZATION AND INVOICE

64125

PUBLICATIONS AUTHORIZATION (To be completed by agency):

TO: (NAME AND ADDRESS OF NEWSPAPER)	FEDERAL I D NO /SOC SEC NO	FROM: (NAME AND ADDRESS OF AGENCY)	AGENCY TELEPHONE NO
PHILADELPHIA INQUIRER 440 N BROAD ST PO BOX 8527 PHILADELPHIA PA 19101	23-1717558 Ad #1RQ800200	VICKIE WALTERS DEP- AIR QUALITY 400 MARKET ST 12th FL. PO BOX 8468 HARRISBURG PA 17105-8468	717-787-9495

HEREWITH IS ENCLOSED COPY FOR PUBLICATION OF ADVERTISEMENT FOR PROPOSALS TO

☐ EMPLOY ☐ PURCHASE ☐ CONTRACT ☐ SELL

TYPE OF AD: DISPLAY AD ☒ CLASSIFIED ☐ LEGAL NOTICE

PUBLISH ADVERTISEMENT (NO OF TIMES)	MAXIMUM NO OF LINES	DATE	ORDER NO
3	2 column display ad		

DATES OF INSERTION	SIGNATURE FOR AGENCY
JAN 31, FEB 2, FEB 3	[signature], Auth.

You, as vendor, are authorized to publish this advertisement in your newspaper, subject to the terms of this order, as follows: Advertisement to be published in regular advertising columns, no position specified; caption of two lines and signature to be in capitals and subject matter and title of officer to be set solid in type regularly used by your newspaper for public (legal) notice advertising; charge to be made at the rate charged to and paid by commercial advertisers for matter similarly set and occupying similar space; advertisement to be run in the editions specified above. Vendor agrees that, in the performance of any contract awarded to it hereunder, said vendor will not discriminate against any employe or other persons on account of race, color, sex, religious creed, ancestry, age or national origin and that the Commonwealth, upon receipt of satisfactory evidence of such discrimination, shall have the right to cancel said contract. Return this copy at once if you will not accept this advertisement under the terms set forth.

Proof of advertising in the form of a tearsheet must be included on Parts 1, 2 & 3. Return original and two copies (signed by the editor or publisher) to Agency listed above. Part 1 must be notarized. Part 4 is yours.

Commonwealth to be billed only for actual number of printed lines published.

ACCOUNT CODE	FUND	DEPT	APP	YEAR	LDG	ORG	COST FUNCTION	OBJ	AMOUNT
	001	035	16	97	1	2700	06408	325	

INVOICE (To be completed by publisher):

	DATE OF INSERTION	ACTUAL NO OF PRINTED LINES	COST PER LINE	TOTAL AMOUNT
1st Ad	January 31, 1998	(2 x 72) 144	$11.30	$1,627 20
2nd Ad	February 2, 1998	144	$11.30	1,627 20
3rd Ad	February 3; 1998	144	$11.30	1,627 20
Acct #076046202 (Tel. #717-787-4325ZZR)			GRAND TOTAL →	$4,881 60

Commonwealth of Pennsylvania
County of Philadelphia

Before me, the subscriber, a Notary Public [illegible] M. Ruchalski who being duly sworn, doth depose and say that he [illegible] erk the Philadelphia Inquirer [illegible] N. Broad St. that the advertisement, of which tearsheet is attac[illegible] dvertising columns of said newspaper, in the editions of said newspaper, in all respects [illegible] at the Commonwealth is not charged therefor at a rate higher than is charged any ordin[illegible] ount of matter occupying similar space and set in a similar manner, in said newspaper.

Sworn and subscribed before me this ____ day of February

[signature] NOTARY PUBLIC

NOTA[illegible] City of Philade[illegible] My Commission [illegible]

My commission expires

Ruchalski
SIGNATURE OF AFFIANT

*This affidavit must be made by the Owner, Publisher, or the des[illegible]

[illegible]

Notice of Public Hearing

Proposed Revision to the State Implementation Plan for Ozone Meeting the Requirements of the Alternative Ozone Attainment Demonstration Policy (Phase I and II)

Ground-level ozone levels above the federal health-based standard are a serious [illegible] health threat, and also can cause damage to [illegible] food crops, forests, and wildlife. The Commonwealth of Pennsylvania is seeking public comment on [illegible] required by the Clean Air Act to [illegible] in the Philadelphia ozone [illegible] Chester, Delaware, Mon[illegible] [illegible] volatile organic [illegible] by three percent per year after 1996 until [illegible] and to demonstrate that the area will meet the [illegible] ozone standard.

States may [illegible] two phases. The Phase I plan [illegible] from 1990 to 1996 and commits to adopt additional necessary controls. The Phase II plan documents subsequent reductions, describes current air quality monitoring and provides air quality modeling information for the attainment demonstration. It also [illegible] Pennsylvania's efforts to re[illegible] from outside its borders. The Department of Environmental Protection (DEP) proposes to submit these documents to the federal Environmental Protection Agency as a revision of the Pennsylvania State Implementation Plan (SIP) for ozone.

The Department [illegible] to receive comments on both of the proposed SIP revisions. The public hearing will be held at [illegible] March 2, 1998 at the Department of Environmental Protection's office at [illegible] Conshohocken [illegible]

Persons wishing to present testimony at the hearing should contact Vickie Walters [illegible] or at P.O. Box [illegible], Harrisburg, PA [illegible] to present [illegible] testify, you [illegible] after pre-registered witnesses. Each witness [illegible] oral testimony to 10 minutes. Please submit [illegible] copies of the oral testimony at the hearing. Each organization should designate one witness to present testimony on its behalf.

Persons interested in submitting written comments should send the comments to J. Wick Havens, Chief, Division of Air Resource Management, P.O. Box 8468, Harrisburg, PA 17105-8468. Written comments on Phase I [illegible] received by the close of business [illegible] 1998. Written comments on Phase II must be received by the close of business, March [illegible], 1998. Copies of the proposed revision may be obtained from Mr. Havens at the above address or by telephone at 717-[illegible] (e-mail: Havens.Wick@A1.dep.state.pa.us). This proposal is also available on the DEP Web site at [illegible] (choose Public Participation Center/Proposals Open for Comment).

Persons with a disability who [illegible] hearing [illegible] an auxiliary aid [illegible] accommodation to participate in [illegible] should contact Mr. Havens at the above [illegible] number, or for TDD users, the [illegible] 1-800-654-5984 to discuss how the [illegible] accommodate their needs.

Pennsylvania Department of Environmental Protection
Rachel Carson State Office Building
P.O. Box 2063
Harrisburg, PA 17105-2063

July 31, 1998

The Secretary 717-787-2814

Mr. W. Michael McCabe
US Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103-2029

Dear Mike:

Enclosed for your approval is a revision to the Pennsylvania State Implementation Plan for the Philadelphia Ozone Nonattainment Area. This revision is the "Phase I" plan and fulfills both the three percent per year reduction requirement in emissions of volatile organic compounds as required by Section 182 of the 1990 Clean Air Act, as Amended, and the requirements described in the March 2, 1995, memorandum from EPA Assistant Administrator Mary Nichols outlining the alternative ozone attainment demonstration policy.

This revision also establishes the 1990 base year inventory for oxides of nitrogen (NO_x) and supersedes all prior NO_x inventory submissions.

Five copies of the Phase I plan and one set of the appendices are enclosed. Should you have questions regarding this submittal, contact James M. Salvaggio, Director, Bureau of Air Quality, at 717-772-4978.

Sincerely,

James M. Seif
Secretary

RECEIVED
AUG 4 1998
Air Protection Division (3AP21)

REV 12-88

64125

PUBLICATIONS AUTHORIZATION AND INVOICE

PUBLICATIONS AUTHORIZATION (To be completed by agency):

TO (NAME AND ADDRESS OF NEWSPAPER)	FEDERAL I.D. NO. SOC. SEC. NO.	FROM (NAME AND ADDRESS OF AGENCY)	AGENCY TELEPHONE NO.
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You, as vendor, are authorized to publish this advertisement in your newspaper, subject to the terms of this order as follows: Advertisement to be published in regular advertising columns, no position specified; caption of two lines and signature to be in capitals and subject matter and title of officer to be set solid in type regularly used by your newspaper for public (legal) notice advertising; charge to be made at the rate charged to and paid by commercial advertisers for matter similarly set and occupying similar space; advertisement to be run in the editions specified above. Vendor agrees that, in the performance of any contract awarded to it hereunder, said vendor will not discriminate against any employe or other persons on account of race, color, sex, religious creed, ancestry, age or national origin and that the Commonwealth, upon receipt of satisfactory evidence of such discrimination, shall have the right to cancel said contract. Return this copy at once if you will not accept this advertisement under the terms set forth.

Proof of advertising in the form of a tearsheet must be included on Parts 1, 2 & 3. Return original and two copies (signed **by the editor or publisher) to Agency listed above. Part 1 must be notarized. Part 4 is yours.**

Commonwealth to be billed only for actual number of printed lines published.

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3rd Ad	February 3, 1998	144	$11.30	1,32[illegible]
Acct #076046202 (Tel. #717-787-4325ZZR)			**GRAND TOTAL →**	$4,3[illegible]

Commonwealth of Pennsylvania
County of Philadelphia

Before me, the subscriber, a Notary Public i[...] M. Ruchalski [...] who being duly sworn, doth depose and say that he [...] erk [...] the Philadelphia Inquirer [...] N. Broad St. [...] that the advertisement, of which tearsheet is attac[hed ...] dvertising columns of said newspaper in the editions of said newspaper, in all respects [...] at the Commonwealth is not charged therefor at a rate higher than is charged any ordin[ary ...] ount of matter occupying similar space and set in a similar manner, in said newspaper.

Sworn and subscribed before me this ____ day of February

[signature] NOTARY PUBLIC — NOTA[RIAL SEAL] City of Philad[elphia] My Commission [...]

My commission expires

[signature: Ruchalski]
SIGNATURE OF AFFIANT

*This affidavit must be made by the Owner, Publisher, or the des[...]

[illegible]

Notice of Public Hearing

Proposed Revision to the State Implementation Plan for Ozone Meeting the Requirements of the Alternative Ozone Attainment Demonstration Policy (Phase I and II)

Ground-level ozone levels above the federal health-based standard are a serious human health threat, and also can cause damage to [illegible] crops, forests, and wildlife. The Commonwealth of Pennsylvania is seeking public comment on [illegible] required by the Clean Air Act to [illegible] in the Philadelphia ozone [illegible] Chester, Delaware, Mon[illegible] volatile organic c[illegible] per cent per year after 1996 until [illegible] and to demonstrate that the area will meet the [illegible] standard.

States may [illegible] two phases. The Phase I plan [illegible] from 1990 to 1996 and commits to adopt additional necessary controls. The Phase II plan documents subsequent reductions, describes current air quality monitoring and provides air quality modeling information for the attainment demonstration. It also [illegible] Pennsylvania's [illegible] to reduce [illegible] from outside [illegible]. The Department of Environmental Protection (DEP) proposes to submit these documents to the federal Environmental Protection Agency as a revision of the Pennsylvania State Implementation Plan (SIP) for ozone.

The Department will hold a public hearing to receive comments on both of the proposed SIP revisions. The public hearing will be held at [illegible] on March 2, 1998 at the Department of Environmental Protection's office at [illegible] North Lane, Conshohocken, PA.

Persons wishing to present testimony at the hearing should contact Vickie Walters at [illegible] or at P.O. Box [illegible], Harrisburg, PA 17[illegible] to present [illegible] to testify, you will [illegible] after pre-registered witnesses. Each witness [illegible] oral testimony to 10 minutes. Please submit [illegible] copies of the oral testimony at the hearing. Each organization should designate one witness to present testimony on its behalf.

Persons interested in submitting written comments should send the comments to J. Wick Havens, Chief, Division of Air Resource Management, P. O. Box 8468, Harrisburg, PA 17105-8468. Written comments on Phase I [illegible] by the close of business [illegible] 1998. Written comments on Phase II must be received by the close of business, March [illegible], 1998. Copies of the proposed revision may be obtained from Mr. Havens at the above address or by telephone at 717-[illegible] (e-mail: Havens.Wick@A1.dep.state.pa.us). This proposal is also available on the DEP Web site at [illegible] (choose Public Participation Center/Proposals Open for Comment).

Persons with a disability who [illegible] hearing, and require an auxiliary aid, [illegible] accommodation to participate in [illegible] contact Mr. Havens at the above [illegible] number, or for TDD users, the A[illegible] 1-800-654-[illegible] to discuss how the [illegible] accommodate their needs.

Pennsylvania Department of Environmental Protection

Notice of Public Hearing

Proposed Revision to the State Implementation Plan for Ozone
Meeting the Requirements of the
Alternative Ozone Attainment Demonstration Policy
(Phase I and II)

Ground-level ozone concentrations above the federal health-based standard are a serious human health threat, and also can cause damage to important food crops, forests, and wildlife. The Commonwealth of Pennsylvania is seeking public comment on two plans required by the Clean Air Act to reduce ozone concentrations in the Philadelphia ozone nonattainment area (Bucks, Chester, Delaware, Montgomery and Philadelphia counties). Together, these plans meet the requirements for reducing volatile organic compounds (or equivalent) by three percent per year from 1996 through 2005 and demonstrating that the area will meet the health-based ozone standard.

States may meet these requirements in two phases. The Phase I plan documents reductions from 1996 through 1999 and commits to adopt additional necessary controls. The Phase II plan documents subsequent reductions, describes current air quality monitoring and provides air quality modeling information for the attainment demonstration. It also describes Pennsylvania's efforts to reduce transport of pollution from outside its borders. The Department of Environmental Protection (DEP) proposes to submit these documents to the federal Environmental Protection Agency to revise the Pennsylvania State Implementation Plan (SIP) for ozone.

The Department will hold a public hearing to receive comments on both of the proposed SIP revisions. The public hearing will be held at 1 p.m. on March 2, 1998 at the Department of Environmental Protection's office at 555 North Lane, Conshohocken, PA.

Persons wishing to present testimony at the hearing should contact Vickie Walters at 717-787-9495 or at P.O. Box 8468, Harrisburg, PA 17105 to reserve a time to present testimony. If you do not reserve a time to testify, you will be able to testify after pre-registered witnesses. Each witness must keep oral testimony to 10 minutes. Please submit three written copies of the oral testimony at the hearing. Each organization should designate one witness to present testimony on its behalf.

Persons interested in submitting written comments should send the comments to J. Wick Havens, Chief, Division of Air Resource Management, P.O. Box 8468, Harrisburg, PA 17105-8468. Written comments on Phase I must be received by the close of business, April 10, 1998. Written comments on Phase II must be received by the close of business, March 9, 1998. Copies of the proposed revision may be obtained from Mr. Havens at the above address or by telephone at 717-787-4310 (e-mail: Havens.Wick@A1.dep.state.pa.us). This proposal is also available on the DEP Web site at http://www.dep.state.pa.us (choose Public Participation Center/Proposals Open for Comment).

Persons with a disability who wish to attend the hearing, and require an auxiliary aid, service or other accommodation to participate in the proceeding, should contact Mr. Havens at the above address or telephone number; or for TDD users, the AT&T Relay Service at 1-800-654-5984 to discuss how the Department can best accommodate their needs.

OPENING STATEMENT

**Proposed Revision to the State Implementation Plan for Ozone
Meeting the Requirements of the
Alternative Ozone Attainment Demonstration Policy
(Phase I and II)**

March 2, 1998

I would like to welcome you to the public hearing on two proposed revisions to Pennsylvania's State Implementation Plan for the Philadelphia Ozone Nonattainment Area.

My name is Arleen Shulman. I am chief of the Mobile Source Section of the Department of Environmental Protection's Bureau of Air Quality. Notice of today's hearing was provided in the Pennsylvania Bulletin on January 31, 1998.

Ground-level ozone concentrations above the federal health-based standard are a serious human health threat, and also can cause damage to important food crops, forests, and wildlife. The Commonwealth of Pennsylvania is seeking public comment on two plans required by the Clean Air Act to reduce ozone concentrations in the Philadelphia ozone nonattainment area (Bucks, Chester, Delaware, Montgomery and Philadelphia counties). Together, these plans meet the requirements for reducing volatile organic compounds (or equivalent) by three percent per year from 1996 through 2005 and demonstrating that the area will meet the health-based ozone standard.

States may meet these requirements in two phases. The Phase I plan documents reductions from 1996 through 1999 and commits to adopt additional necessary controls. The Phase II plan documents subsequent reductions, describes current air quality monitoring and provides air quality modeling information for the attainment demonstration. It also describes Pennsylvania's efforts to reduce transport of pollution from outside its borders.

I would like to establish the following ground rules for this hearing:

> Pre-registrants will testify first. I will then provide any interested parties with the opportunity to testify. Please limit oral testimony to 10 minutes. Each witness is asked to submit written copies of the testimony. Please state your name and address for the record prior to presenting your testimony and spell any unfamiliar names or terms that are not in your written testimony.

Interested persons are encouraged to submit written comments instead of or in addition to oral testimony to Wick Havens, Chief, Division of Air Resource Management, P.O. Box 8468, Harrisburg, PA 17105-8468. Written comments on Phase I must be received by the close of business, April 10, 1998. Written comments on Phase II must be received by the close of business, March 9, 1998. All comments received at today's hearing and in writing by these dates will be considered and become part of a comment/response document prepared for submission as part of this SIP to the federal Environmental Protection Agency.

I would like to call the first witness.

March 3, 1998

TO: THE RECORD

FROM: Arleen Shulman, Mobile Source Section Chief

The public hearing on the Philadelphia Ozone Nonattainment Area Phase I and Phase II State Implementation Plan revisions was convened at the Conshohocken Regional Office at 1 PM. The reading of the opening statement was dispensed with, although those present were reminded of the written public comment deadlines. With the absence of anyone presenting oral testimony, the hearing was adjourned at 1:25 PM. Two observers were present (Tony Ippolito, Sun Company and Thomas Weir, AMS Philadelphia).

March 2 Philadelphia Ozone
SIP Hearing Phase I/II
SIGN IN

NAME & ADDRESS	TESTIFY? (Y/N)
Tony Ippolito Sun Co 1801 Market St. Philadelphia, Pa. 19103	N
Thomas Weir AMS Phila. 321 University Ave Phila, Pa, 19104	N

The Commonwealth of Pennsylvania
Department of Environmental Protection

State Implementation Plan (SIP) Revision for the Philadelphia Interstate Ozone Nonattainment Area Meeting the Requirements of the Alternative Ozone Attainment Demonstration Policy

Phase II

April 1998

http://www.dep.state.pa.us

Division of Air Resource Management
Bureau of Air Quality
Pennsylvania Department of Environmental Resources
PO Box 8468
Harrisburg, PA 17105-8468
717-787-4310

J. Wick Havens, Chief

Phase II Ozone SIP Submittal

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G. AREA/NONROAD SOURCE DOCUMENTATION
H. HIGHWAY VEHICLE MODELING DOCUMENTATION

APPENDIX IV: MONITORING INFORMATION

APPENDIX V: MODELING INFORMATION

Protocol for Regulatory Photochemical Air Quality Modeling of the Metropolitan Philadelphia - Southern/Central New Jersey Area, February 1992

Technical Support Documentation Summary, April 1995

Sensitivity Studies for Assessing the Impact of Emissions Reductions, December 1997

Appendix to Sensitivity Studies for Assessing the Impact of Emissions Reductions, December 1997

Comparative Evaluation of Methods for Estimating Potential Human Exposure to Ozone: Photochemical Modeling and Ambient Monitoring, December 1997

Estimation and Visualization of Potential Human Exposure to Ozone, December 1997

The Use of Geographic Information System Tools to Improve Assessment of Air Quality Associated with Mobile and Biogenic Source Emissions, December 1997

Overview of Computational Tools, December 1997

Cross-Evaluation of Observational and Mechanistic Approaches for Studying the Relationship Between Tropospheric Ozone and Precursor Species (NOx and VOC), December 1997

Petition of the Commonwealth of Pennsylvania For Abatement of Excess Emissions, August 14, 1997

List of Tables, Figures, and Maps Contained in the Phase II Plan

1. Executive Summary

Ozone and Its Precursors. Ground-level ozone continues to be the primary air pollution problem in Pennsylvania. While successes have been won in many parts of the state, the Philadelphia Metropolitan area still exceeds the one-hour health-based standard for ozone on numerous occasions during the summer months. Reducing concentrations of ground-level ozone is important because ozone levels above the health-based standard are a serious human health threat, and also can cause damage to important food crops, forests, and wildlife. (Ground-level ozone should not be confused with stratospheric ozone – located in the upper atmosphere – which protects the earth by blocking out damaging solar radiation.)

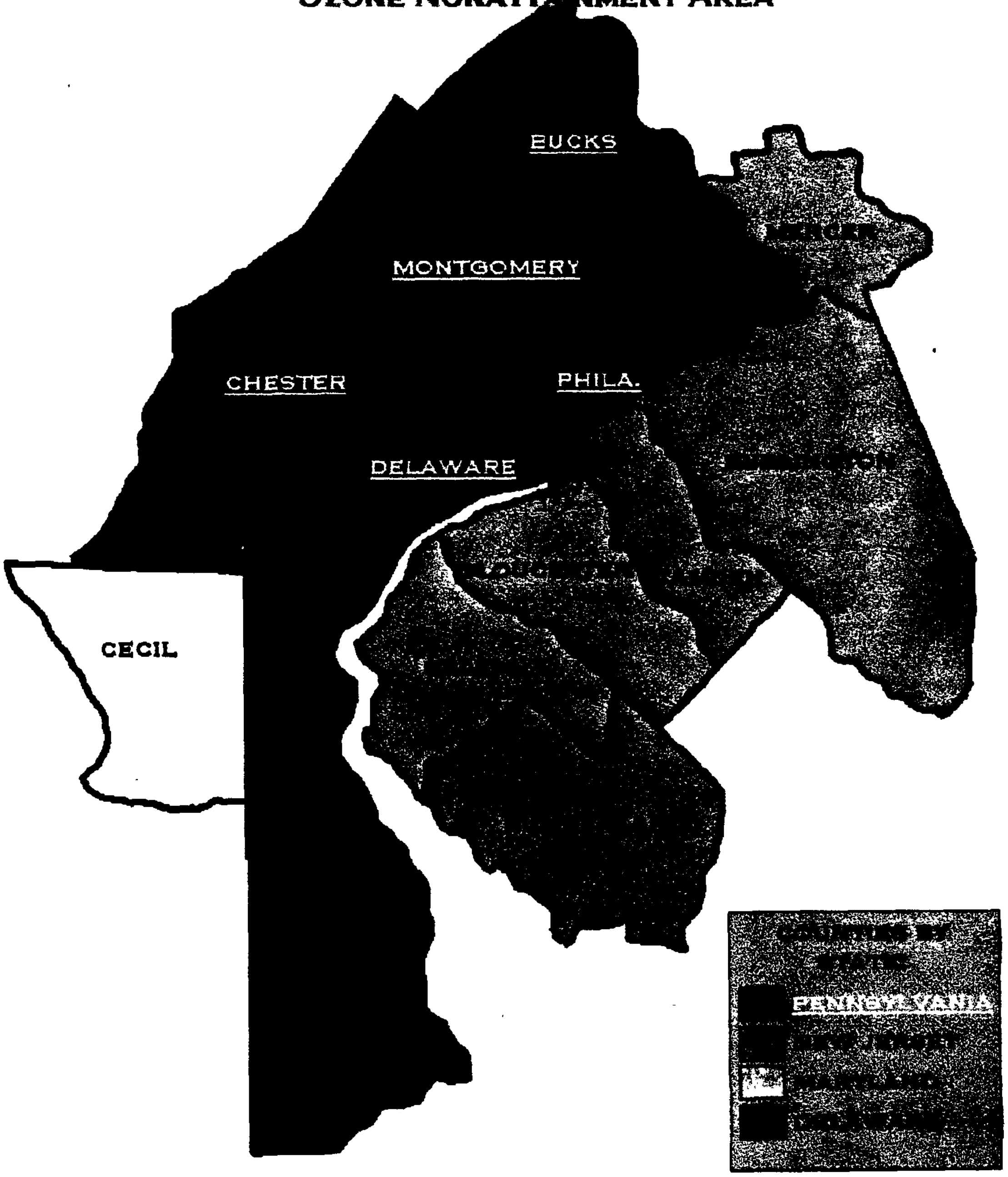
Ozone is not emitted directly to the atmosphere, but is formed by photochemical reactions between volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) in the presence of sunlight. The long, hot, humid days of summer are particularly conducive to ozone formation, so ozone levels are of general concern during the months of May through September.

The primary man-made sources of VOCs and NO_x, the ozone precursors, are the evaporation of fuels and solvents (gasoline and consumer products), combustion of fuels (motor vehicles, power plants, and other industries), and chemical and industrial processes. The catalog of ozone precursors for a given year is called an "emissions inventory."

State Implementation Plan (SIP) Requirements. The Clean Air Act Amendments of 1990 (CAAA) require states to design strategies to reduce ozone and its precursors in order to meet the rate-of-progress requirements and the health-based standard. The five counties in southeast Pennsylvania are part of a four-state ozone nonattainment area (*Map 1*). This multi-state nonattainment area is classified as "severe" nonattainment for ozone, and as such has until 2005 to reach attainment of the one-hour standard of 0.12 parts per million (ppm). The requirements of a severe non-attainment area are described in Sections 110 and 172 and Subpart 2 of Part D of the CAAA. In accordance with these requirements and EPA policy, states are permitted to design plans that demonstrate progress toward attainment in a stepwise fashion, by meeting interim emission reduction "milestones" at various points between 1990 and 2005, the attainment year.

On March 2, 1995, EPA issued a policy whereby states could commit to a two-phased approach to meet the statutory requirements. The Phase I requirements include adoption of specific control strategies necessary to meet the Post 1996 Rate-of-Progress plan through 1999; commitments to adopt, or adoption of, other CAAA-mandated and regional control programs; and modeling with interim assumptions.

Map 1 – Philadelphia Interstate Ozone Nonattainment Area



The Phase II requirements include participation in a two-year regional consultative process with other states in the eastern United States, and with EPA to identify and commit to additional emission reductions necessary to attain the health-based ozone standard by the statutory dates. Pennsylvania committed to this alternative two-phased approach in a letter sent to EPA on May 31, 1995. The Commonwealth offered Phase I and Phase II for public comment simultaneously. Phase II is contained in this volume.

Measures Adopted To Reduce Ozone Precursors. Pennsylvania began adopting ozone control measures in 1979, adding specific controls to general permitting authority. In addition, federal measures have and will continue to contribute significantly to air quality improvements in Pennsylvania. Many of the recommendations of the Southeast Ozone Stakeholder Working Group are in the process of adoption to continue Pennsylvania's progress. Controlling nitrogen oxide emissions outside of the nonattainment area will also assist the Philadelphia nonattainment area to meet health standards. These strategies will result in significant and continuing emission reductions before and after 2005.

Rate-Of-Progress Demonstration. In addition to the 15% reduction required by 1996, the Philadelphia area must continue to reduce VOC emissions by at least 3% annually until 2005 and must also offset any growth in emissions.

A total of 616 tons per summer day (tpsd) of VOCs were emitted by man-made sources in 1990. In order to meet Rate-Of-Progress (ROP) requirements, emissions in the nonattainment area must be reduced to no more than 381 tpsd in 2002 and 328 tpsd in 2005. State, local, and federal control measures will lead to VOC-equivalent emissions of 308 tpsd in 2002, and 218 tpsd in 2005, thus meeting the ROP requirements. (After 1996, the ROP requirement may include reductions in both VOCs and NO_x.) *Table 1* lists the control measures for which credit is taken in the ROP demonstration.

Figure 1 summarizes what emissions would be without controls required by the Clean Air Act Amendments of 1990 (uncontrolled), the emissions which represents the rate of progress requirement (target level) and the emissions expected after control measures have been applied (controlled). The plan also contains a highway vehicle emissions budget for purposes of transportation conformity.

Monitored Data Trend Analysis. Trend analyses performed on Philadelphia regional monitoring data indicate ozone concentrations have declined. Ozone monitoring data show the Philadelphia Interstate Ozone Nonattainment Area's design value has declined 48% between 1976 and 1997. Peak one-hour ozone concentrations show slightly larger declines, with decreases ranging from 49% to 13%. These results suggest that emission reduction programs have been effective and that air quality in the Philadelphia region has improved significantly since 1974. Both the spatial extent and severity of ozone levels across the area have been substantially reduced.

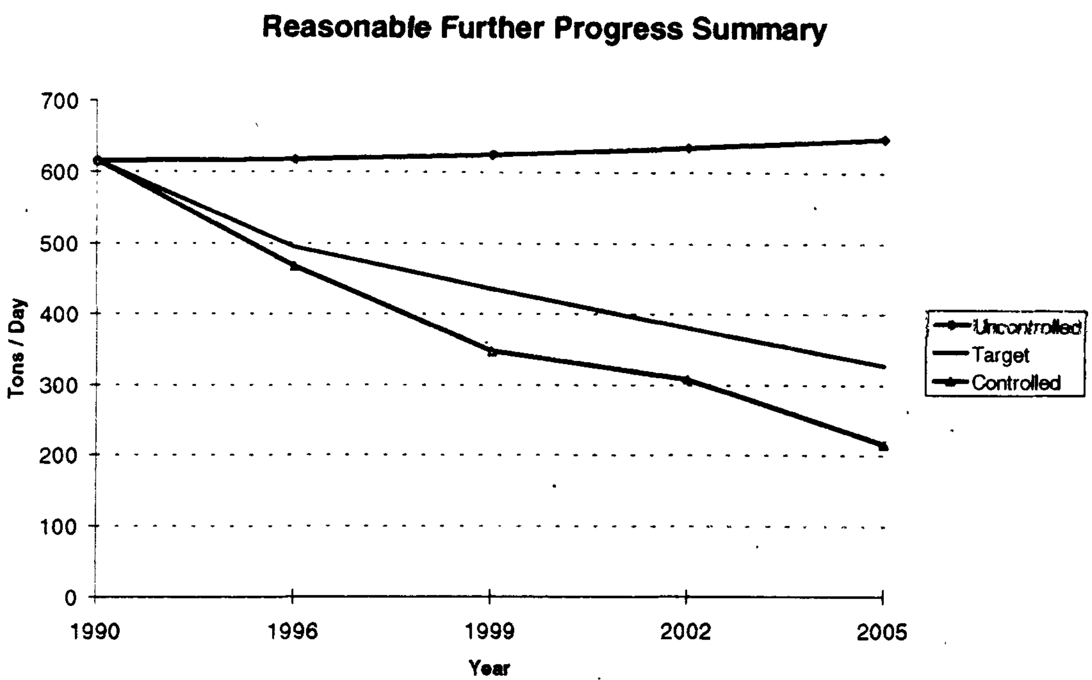


Table 1: Control Measures Used to Attain the Rate-Of-Progress Requirements

Point Source Controls	Highway Vehicle Controls
• Improving rule effectiveness from 80 to 90 percent • VOC and NO_x Reasonably Available Control Technology (RACT) • NOx allowance requirements • Source shutdowns	• Tier 1 of the Federal Motor Vehicle Control Program • Enhanced vehicle inspection and maintenance • Federal reformulated gasoline
Area Source Controls	***Nonroad Vehicles***
• Federal controls on architectural and industrial surface maintenance coatings • Stage II vapor recovery • Federal autobody refinishing rules • Consumer product reformulation • Federal controls on treatment, storage and disposal facilities for hazardous waste	• Reformulated gasoline use • Federal standards for new diesel engines • Federal standards for new small engines

Air Quality Modeling. Rutgers University has completed substantial photochemical modeling for three high-ozone episodes. Modeling refinement and development of additional episodes is continuing. The model has been shown to perform adequately in predicting known monitored ozone concentrations for the Philadelphia area from emissions and meteorological data. Modeling for expected emission reductions in 2005 after application of Clean Air Act required controls shows substantial reductions in the spatial extent of nonattainment in the area. Both the persistence and severity of nonattainment are greatly reduced. Peak concentrations are also reduced, though not as significantly as persistence and severity. Additional emission reductions are expected to occur beyond those modeled to date as a result of state and federal actions.

Interstate Transport. On August 14, 1997, Pennsylvania filed a petition with EPA under Section 126 of the Clean Air Act (a copy of that petition is available upon request). The Petition requests that EPA establish emission limitations for certain large sources of NO_x to reduce transported air pollution. Similarly, on October 10, 1997, EPA announced a proposal to require 22 states and the District of Columbia to submit SIPs that address the regional transport of ozone and ozone precursors, based in part on the recommendations of the Ozone Transport Assessment Group (OTAG). In that rule, EPA made a proposed finding that "22 States and the District of Columbia significantly contribute to nonattainment in, or interfere with maintenance by, a downwind State." The rule is expected to be finalized in the fall of 1998. It is anticipated that sources upwind of Pennsylvania will install required controls to achieve a reduction in emissions of 55% from the 1990 baseline by December 1999 with additional reductions, if necessary, by 2003.

Attainment of the one-hour ozone standard has been impossible due to the transport of ozone and ozone precursors into the area. While local emission reduction programs have substantially improved air quality, at times the area still experiences ozone levels in excess of the standard. Measured ozone air quality data continue to demonstrate that ozone levels entering the area exceed the standard levels. This overwhelming transport makes development of an attainment plan difficult without federal action on the 110 SIP call or Section 126 petition.

Preliminary predicted reductions from these actions based on OTAG modeling indicate reductions of 12 to 20 ppb. Since the current design value for the Philadelphia areas is 138 ppb, the result would be 118 to 126 ppb compared to the standard of 124 ppb. Thus, it is not unreasonable to predict that appropriate reduction of transport when combined with ongoing programs will lead to attainment of the one-hour standard.

2. Introduction

2.1 The Ozone Problem – Why It Is Important To Lower Concentrations of Ozone

The Clean Air Act requires the federal Environmental Protection Agency (EPA) to establish national health-based standards for six major air pollutants. Attainment of the health-based standard for one of the six – ground-level ozone – continues to be Pennsylvania's biggest challenge. The Clean Air Act Amendments of 1990 (CAAA), redesigned the process states must follow to develop attainment plans, classified non-attainment areas based on the extent of the ozone problem, and extended attainment dates.

Reducing concentrations of ground-level ozone is important because ozone is a serious human health threat; it also can cause damage to important food crops, forests, and wildlife. Ground-level ozone should not be confused with stratospheric ozone – located high above the ground in the upper atmosphere – which protects the earth by blocking out damaging solar radiation.

Ozone is a difficult pollutant to address because it is not emitted directly, but rather is formed by complex chemical reactions of ozone precursors – volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) – in the presence of sunlight. The long, hot, stagnant days of summer are particularly conducive to ozone formation, so ozone levels are of general concern during the summer months. VOC emissions have origins as diverse as automobiles, chemical manufacturing, paint shops, and other sources using solvents, while NO_x emissions are produced primarily by fuel combustion in utility, industrial and transportation sources.

Ozone causes human health problems because it damages lung tissue, reduces lung function, and sensitizes the lungs to other irritants. Scientific evidence indicates that elevated ambient levels of ozone not only affect asthmatics and others with impaired respiratory systems, but also healthy adults and children, especially those who exercise or work outside. Exposure to ozone for several hours at relatively low concentrations has been found to significantly reduce lung function and induce respiratory inflammation in healthy people during exercise. This decrease in lung function generally is accompanied by symptoms including chest pain, coughing, sneezing, and pulmonary congestion.

2.2 The "Two-Phased" Attainment Plan Process

Pennsylvania is responsible for developing state implementation plans (SIPs) for air quality for the five Pennsylvania counties of the Philadelphia Interstate Ozone Nonattainment Area – Bucks, Chester, Delaware, Montgomery, and Philadelphia counties. These counties are part of a four-state (Pennsylvania, New Jersey, Delaware, and Maryland) ozone non-attainment area. See *Map 1* for the entire nonattainment area.

The Philadelphia nonattainment area is classified as "severe" nonattainment for ozone. This plan refers only to the five-county Pennsylvania portion of the Philadelphia nonattainment area. This plan also addresses only the health-based ozone standard in effect at the time the CAAA of 1990 was enacted (0.12 parts per million or 124 parts per billion averaged over one hour). While a new ozone standard (0.08 parts per million averaged over eight hours) was finalized in July 1997, states are still responsible for SIP submissions pertaining to the one-hour standard under Title 1 of the CAAA.

The Philadelphia area was required to submit a State Implementation Plan (SIP) by November 15, 1993 to reduce volatile organic compound (VOC) emissions by 15% in 1996 (from 1990 levels). EPA signed an interim conditional approval of that plan on May 30, 1997

Severe non-attainment areas, such as the five-county Philadelphia area, were also required to submit a State Implementation Plan (SIP) by November 15, 1994 to reduce volatile organic compound (VOC) emissions by 3% annually from 1996 through 2005, and demonstrate that enforceable measures would bring the area into attainment with the ozone standard no later than 2005. The annual percentage reduction requirement is referred to in this plan as Rate of Progress (ROP). Since ozone is not emitted directly, complex photochemical models are necessary to predict ozone levels from projected emissions and meteorological conditions. Results of these models were to be used to demonstrate that the health-based standard would be achieved in 2005 even in worst-case weather conditions after emission controls are in place.

To meet these requirements, Pennsylvania submitted a ROP and attainment SIP on November 12, 1994. EPA did not propose any formal action on the submission, and as a result, the SIP was deemed complete by action of law six months later.

Most other states facing the same requirement, including all of the northeastern states, were unable to submit their plans by the November 15, 1994 deadline. Realizing that many states, especially those that were significantly affected by interstate transport of ozone and ozone precursors, were having great difficulty developing credible attainment plans, EPA issued a policy outlining an alternative approach. This so-called "Two-

Phased" approach, issued in a memo signed by EPA Assistant Administrator for Air and Radiation Mary Nichols on March 2, 1995, allows states much more flexibility in their planning efforts. Pennsylvania agreed to the alternative approach in a letter to EPA dated May 31, 1995. (See *Appendix I* for both documents.)

In Phase I, geared toward achieving local emission reductions, Pennsylvania must submit a plan to implement specific control measures to reduce emissions of VOCs by 24% by 1999 from 1990 levels and to commit to adopt measures needed for attainment and to address transport. After 1996, NO_x emission reductions can be substituted for VOC emission reductions to meet ROP requirements. EPA established the end of 1995 as the due date for Phase I submittals but submittal dates in 1996 were to be negotiated if necessary. On May 7, 1997, EPA triggered the 18-month time clock for mandatory application of sanctions in Pennsylvania under the Clean Air Act for failure to submit a Phase I plan. Pennsylvania's Phase I, contained in a separate document, will be submitted to EPA in time to prevent the imposition of mandatory sanctions, no later than November 7, 1998. The public comment period on Phase I began January 31, 1997. Because the Phase I plan contains commitments to adopt control measures, the Air Pollution Control Act requires review of the plan and public comments by the Environmental Quality Board; this review is scheduled for July 21, 1998.

Phase II is designed to address the more difficult task of actually attaining the health-based standard – especially dealing with transport of ozone and ozone precursors – by continuing with necessary local control measures and implementing regional control strategies. Most areas of the Northeast, including the Philadelphia area, will be unable to attain and maintain the one-hour health-based standard for ozone without a consistent level of emission reductions throughout the Midwest, Northeast and Southeastern United States. Phase II was originally anticipated to be submitted in 1997; EPA has extended that submission date to April 1998.

Requirements for public process are detailed in 42 USCA 7410(a)(2)and 40 CFR 51.102(d). The comment period on Phase II opened on January 31, 1998. A public hearing was held on March 2, 1998. The comment period closed on March 9, 1998. DEP is submitting a comment/response document as part of this SIP submission.

2.3 What This SIP Submission Contains

This is the Phase II submission for the Philadelphia nonattainment area.

- Chapter 3 describes the regulatory and other measures adopted at the state and federal level to reduce local emissions of VOCs and NO_x. It also contains schedules for measures in development or under consideration and describes federal measures anticipated to reduce emissions in the future.

- Chapter 3 also summarizes the **Rate of Progress** demonstration showing that the Philadelphia nonattainment area will meet its 3% per year VOC reduction requirements from 1999 to 2005, calculated for two milestone years, 2002 and 2005. Technical documentation is contained in Appendix III.

- Chapter 4 summarizes **monitoring information** that shows the marked improvements in ozone air quality from the early 1980s to the present. In-depth information is available in Appendix IV.

- Chapter 5 summarizes the results of **air quality modeling** performed for the Philadelphia nonattainment area by Rutgers University. The modeling is documented in Appendix V.

- Chapter 6 discusses actions Pennsylvania has and anticipates taking to **reduce transport** of ozone and its precursors into the Commonwealth from other states.

3. Ozone Precursor Emissions and Reduction Strategies

Pennsylvania's programs to reduce VOC and NO_x emissions date from the earliest knowledge of the causes of ozone pollution, gaining momentum with the passage of the federal Clean Air Act of 1970. This federal law established dates by which areas needed to attain a health-based ozone standard and gave states primary responsibility to plan for that attainment. It directed EPA to set standards for newly built industrial sources and to provide guidance to states for cost effective controls on existing industrial facilities. At this time, EPA also began setting national tailpipe standards for new cars and trucks.

The Clean Air Act Amendments of 1990 established new schedules and new obligations. It set forth a number of mandatory measures, based on the severity of pollution in each area or presumed contributions to a regional Northeastern United States ozone problem. It established the requirement that areas classified as moderate nonattainment or above reduce emissions by certain percentages. Consequently, Pennsylvania adopted or revised many regulations throughout the 1990s.

Because of the persistence of ozone problems in the Commonwealth's largest urban areas, in January 1996, Governor Ridge convened two stakeholder groups to address the ozone nonattainment issues in Southeast and Southwest Pennsylvania. The stakeholder groups included representatives of local government, environmental, motorist and business groups and citizens in each region. CDR Associates, an independent mediator with an international reputation, was retained by DEP to facilitate the discussions in the stakeholder groups. The groups also formed data management committees and worked with technical consultants on preparation of inventory data and air quality modeling. After nine months of work, their final reports were completed in January 1997.

This was the first time that the people of Pennsylvania were asked to develop their own plans for meeting clean air standards, without the heavy hand of EPA or the state mandating a one-size-fits-all set of control methods. The stakeholders included diverse interests with a common goal as an objective and demonstrated an unprecedented spirit of cooperation. As a result, the stakeholder groups represented a unique and significant milestone in Pennsylvania's efforts to provide clean air. In addressing their recommendations, Pennsylvania will continue to move forward with necessary local emission reductions, while addressing interstate transport issues in a national forum.

3.1 Emission Reduction Measures

Pennsylvania has reduced emissions and expects to achieve further emission reductions from a variety of strategies. This chapter summarizes measures adopted by the Commonwealth to reduce ozone precursor emissions. Measures put in place to reduce emissions will continue air quality improvements over the next decade.

It has been clear that Pennsylvania cannot attain and maintain the ozone health-based standard unless emission reductions greater than 3% per year are realized from both sources in Pennsylvania and in upwind states. Therefore, the Commonwealth is including in this chapter a description and schedule of additional measures in development or under consideration, based on the recommendations of the Southeast Pennsylvania Ozone Stakeholders Working Group. (Chapter 6 addresses the issue of interstate transport.) Strategies that are being implemented but have not been quantified are also discussed. Finally, the chapter summarizes national strategies expected to further reduce emissions.

Some of the strategies below are being used to meet Rate-of-Progress emission reduction milestones. Those measures are described in more detail in Appendix III.

3.1.1 State and Local Measures

Pennsylvania has been actively working to reduce emissions of ozone precursors for many years. The first major ozone control efforts were directed at reducing emissions of volatile organic compounds (VOCs). More recently, the Department has been addressing the need to reduce emissions of nitrogen oxides (NO_x) from sources. Air Management Services of Philadelphia operates similar programs for Philadelphia County point and area sources.

Point Sources. Point sources are utilities, industries, and other operations that emit more than a certain amount of pollution per year. Point sources emit pollution through "smoke" stacks or flues or directly to the atmosphere as "fugitive" emissions (for example, evaporation from a tank).

A second set of industrial regulations is adopted in 1981:

Metal products (Section 129.52). These regulations established emission limits for certain metal products, including topcoats for locomotive and heavy duty trucks, hopper cars, tank car interiors, pails, drum interiors, and general paint coating limits.

Graphic Arts Systems (Section 129.67). Emission limitations were established for graphic arts systems which are printing operations that place patterns on material. This includes printing the design on wall paper or vinyl flooring, among other things.

Pharmaceuticals (Section 129.68). The Department adopted emission limitations for the manufacture of pharmaceuticals.

Tires (Section 129.69). This regulation requires the control of emissions from the use of solvent in the various cements and coatings used in the manufacture of pneumatic rubber tires.

In 1988, the following sources were regulated:

Wood furniture (Section 129.52). The Department's coating regulations for establish solvent limits for the various finishes used in the wood furniture manufacturing industry.

Synthetic organic chemical and polymer manufacturing (Section 129.71). This regulation establishes work practice standards for various equipment in a process and requires a leak detection and repair program similar to one required in the petroleum refineries.

Manufacture of surface active agents (Section 129.72). These agents are finishing agents, sulfonated oils and textile assistants for use as wetting agents, emulsifies and penetrants. The regulation requires the capture and destruction of emissions from the various sources used in the manufacturing process.

Beginning in 1991, a series of changes were made to the existing volatile organic regulations. These changes were designed to clarify and tighten the emission requirements. These changes included changing the definition of volatile organic compound. This change expanded the number of regulated sources resulting in further VOC controls. In addition, the following specific source regulation was added:

Barges and Tankers (Section 129.81). In 1991, regulations were adopted for the control of emissions from the loading and unloading of marine liquid cargo vessels and the ballasting of those vessels. The regulations extend control requirements similar to the Stage I vapor controls to these vessels.

The Air Pollution Control Act requires all point sources to obtain a permit to operate. The Department has issued operating permits, under Chapter 127, to large sources since the early 1970's. Smaller sources are now receiving permits to operate. The Clean Air Act Amendments of 1990 require the Department to issue comprehensive permits to large facilities. These permits, known as Title V permits, list all of the regulatory and compliance requirements for all sources in a plant. In 1996, Pennsylvania's operating permit program under Title V of the CAAA became fully approved. The first Title V permits were issued in 1997.

The Department has been regulating VOCs from point sources since 1979. Since that year, the Department has adopted a number of additional control programs for industrial sources. The following summarizes many of the industrial control measures. All section references are to the *Pennsylvania Code*, Title 25. All definitions can be found in Chapter 121 of that Title.

In 1979, the Department adopted the first set of targeted regulations for a number of sources of VOCs. These regulations have been updated regularly. These regulations established minimum standards. Permits may contain more stringent requirements if applicable under other provisions. These included:

Surface coating processes (Section 129.52) These regulations were directed, primarily, toward industrial sources that use paints or other surface coating compounds. These surface coating rules applied to the coating or covering of cans, coils, automobiles and light duty trucks, paper, vinyl, magnet wire, metal furniture, large appliances and fabric.

Storage and transfer facilities (Sections 129.56, 129.57, 129.59, 129.60, and 129.62). About the same time, the Department adopted regulations to control the loss of VOC vapors from storage and transfer facilities, specifically bulk gasoline terminals and plants.

Petroleum refineries (Sections 129.55 and 129.58). A major source of VOCs in the Philadelphia region is emissions from petroleum refineries. The Department adopted regulations to require control of emissions from specific types of sources within the plant. These sources included wastewater separators, pumps and compressors, and certain process units. In addition, the refineries were required to check and repair leaks from the piping within the refinery.

Ethylene production plants. (Section 129.65). The Department required the combustion of waste gases from the production of ethylene.

New Source Review (Subchapter C of Chapter 127). This regulation required that major new sources obtain emission reductions from existing sources to offset the new source's emissions. The regulation required that new sources install the Lowest Achievable Emission Reduction control equipment.

While initial efforts to reduce ozone concentrated on VOCs, it became evident through research that NO_x control was also needed. Therefore, in the 1990s, DEP's point source regulations concentrated on NO_x:

Reasonably Available Control Technology (RACT) (Sections 129.91-94). In 1994, the Department adopted regulations that required all major sources of NO_x to analyze their sources and implement reasonable control levels. The regulation also applied to sources of VOCs that had not been previously regulated. This was the first major control effort for existing sources of NO_x.

NO_x MOU (Sections 123. 101-120). A second NOx regulation was adopted in 1997, implementing Phase II[1] of the NO_x Memorandum of Understanding (MOU) signed with the Ozone Transport Commission in 1994. Pennsylvania's NO_x Allowance Requirements regulation places a cap on summer NO_x emissions from larger sources (generally utilities) and requires an average reduction of 55% from 1990 emission levels. A NOx trading system has been established to achieve cost effective emission reductions.

Also, the Department extensively revised the **new source review regulations.** These regulations are found in Subchapter E of Chapter 127. These regulations are used in the permit review process followed by the Department. The regulations require that new sources control air pollution to a greater extent than existing sources.

Area Sources. The Department has adopted several control requirements for several area source categories. Area source emissions tend to be small and widely dispersed geographically and are typically not accounted for individually in point source inventories. These include:

Small gasoline storage tanks (Section 129.61). In 1979, the Department adopted regulations ("Stage I") for small gasoline storage tanks. These gasoline tanks are generally the underground tanks found at gasoline service stations. When these tanks are refilled, the vapor in the empty tanks is displaced and had been released to the atmosphere. The regulations require that the vapors be collected and processed.

Degreasing operations (Section 129.63). The Department adopted vapor control regulations for degreasing units, which are designed to use a solvent to clean various metal parts and products before they are further processed or painted.

Asphalt paving operations (Section 129.64). This regulation limited the amount of solvent that can be contained in various grades of asphalt.

[1] This program is called "Phase II" because it is the second phase of NOx controls on these major sources -- Reasonably Available Control Technology (RACT) being the first phase.

Vehicle Refueling (Section 129.82). In 1992, the Department adopted regulations ("Stage II") that required the gasoline vapors from the filling of motor vehicle gasoline tanks to be collected and returned to the service station's storage tanks. This is accomplished by installing Stage II vapor recovery nozzles on the pumps.

Philadelphia County Autobody Refinishing. The county implements a permitting program for autobody refinishing, which includes requirements for paint booths and waste minimization.

The Department has recognized that many of the newer regulations impact smaller businesses. These businesses do not have environmental staffs or extensive resources to track all new environmental initiatives. Enhancing the compliance of small businesses will help achieve reductions in emissions and further progress toward achieving clean air goals.

In 1993, the Department adopted a **small business assistance program.** This program provides confidential assistance to small businesses. The program helps educate sources about new requirements, answers questions, helps with permit applications, and helps coordinate low interest loans for control equipment.

Mobile (Highway) Sources. Highway vehicles remain a significant contributor to emissions, particularly since people are driving more and more miles each year. While the federal government regulates new vehicles, Pennsylvania has taken a number of steps to reduce emissions from vehicles in use or to encourage less polluting travel options:

Vehicle emission inspection/maintenance (I/M) (Pennsylvania Code Title 67, Chapters 175 and 177). Since vehicles deteriorate with time and use, the Clean Air Act required states to design programs to require the repair of light-duty vehicles which emit significantly more pollution than expected for their age. In 1984, the Department of Transportation implemented a basic emission I/M program in the Philadelphia area (as well as counties in the Pittsburgh and Lehigh/Northampton nonattainment areas). This program tested the tailpipe emissions of automobiles and light duty trucks while they were idling and required the repair of failing vehicles.

On October 1, 1997, the Department of Transportation implemented the enhanced I/M program in the Philadelphia area. The enhanced program uses upgraded testing equipment and requires cars to be tested on a dynamometer. These treadmill devices put a vehicle under load and therefore create conditions under which NOx failures may be detected. The inspection now provides additional anti-tampering checks and a test for evaporative emission emissions. The program includes a real-time connection to a central database for data collection and enforcement purposes.

Transportation conformity (Memorandum of Agreement). In 1993, the Department of Transportation, Department of Environmental Protection and all the local planning organizations in nonattainment areas responsible for transportation planning signed a memorandum of agreement on transportation conformity procedures. These procedures require a technical analysis to ensure that, on a regional basis, highway/transit improvements contribute to reductions in ozone precursors. These analyses are required periodically for both transportation improvement programs and long range plans. The agreement also encompasses interagency consultation and public participation processes.

Transportation Measures. The Delaware Valley Regional Planning Commission (DVRPC) is charged with transportation (road and transit) planning in the four-state Philadelphia metropolitan area. After an extensive period of consultation with the public and member agencies on a periodic basis, DVRPC's transportation plans allocate federal and state funding. The Transportation Improvement Program includes a number of projects to relieve congestion and encourage alternatives to single-occupancy vehicles such as transit improvements, the Mobility Alternative Program (regional ride-sharing programs, Transitchek and encouragement of alternative work schedules), park and ride projects and bicycle improvements. These projects also help ensure that the regional (4-state) plans meet transportation conformity requirements.

Voluntary Measures. The Southeast Ozone Stakeholders recognized that regulatory controls are not the only strategy to achieve emission reductions. The Commonwealth and its partners have implemented several incentive- and education-based voluntary programs, though emission reductions have not been quantified. These include:

- the **Ozone Action Partnership**, which alerts the general public to days when ozone is forecast to be unhealthful and asks them to take ozone-reducing actions such as driving less, not mowing lawns;
- **energy conservation programs** administered by DEP's Office of Pollution Prevention and Compliance Assistance;
- a business-based program to promote voluntary **pollution prevention** and best-management-practices programs through DEP's Office of Pollution Prevention and Compliance Assistance; and
- incentives for the use of **alternative fuels** such as natural gas and electricity to power vehicles. Potential users of these vehicles face two significant obstacles -- an increased capital investment and, in some cases, lack of a refueling infrastructure. The Commonwealth's Alternative Fuel Incentive Grant Program funds a portion of the capital costs of building refueling stations and purchasing vehicles. About $11 million has already been allocated. The Commonwealth assists the Greater Philadelphia Clean Cities Program in encouraging alternative fuel use in the area.

Table 2 lists CAAA Title 1 - ozone related regulations submitted to EPA as SIP revisions.

Table 2:

CAAA Title 1 - Ozone Related Regulations

State Implementation Plan	PA Submitted	EPA Approved
EPA APPROVED		
Revised Definition of VOC 25 Pa. Code 121.1	Jan, 11, 1991	November 5, 1992
Group III CTG RACT for VOC from Synthetic Organic Chemical Manufacturing	Sep. 9, 1991	April 6, 1993
Correction of RACT for certain sources	Aug. 15, 1991	May 13, 1993
Good Engineering Practice Stack Height Requirements	July 19, 1991	September 17, 1992
CEMs for NO_x from large combustion sources	Jan. 11, 1991	September 23, 1992
Control of VOC Emissions from Marine Vessel Loading and Ballasting	Nov. 13, 1991	September 28, 1993
Group III CTG RACT for VOC Emissions from Petroleum Solvent Dry Cleaning Facilities in Philadelphia	Feb. 23, 1987	April 12, 1993
Stage II Vapor Recovery	Mar. 4, 1992	June 13, 1994
Control of VOC from Surface Coating, Pneumatic Rubber Tire Manufacturing, Graphic Arts & SOCMI	Dec. 31, 1985; June 29, 1988; Aug. 19, 1992	August 31, 1994
Small Business Assistance Program	Feb.1, 1993	January 5, 1995
Emission Statement	Dec. 31, 1992	May 2, 1996
Revised Enhanced Motor Vehicle I&M Program	Mar.26, 1996	January 28, 1997 (interim conditional)
NO_x and VOC RACT	Feb.4, 1994; Amended May 3, 1994 and Sep. 18, 1995	Mar. 23, 1998 (conditional)
SUBMITTED BUT NOT YET APPROVED		
NO_x Allowance Requirements	December 19, 1997	

3.1.2 Federal Measures

The federal government has adopted a number of programs which are applicable in Pennsylvania.

Point Sources. These programs, in general, tend to be emission limitations or work practices for new sources. Many of these rules apply to new sources. Pennsylvania has required all sources of air pollution to install best available technology since the early 1970s and has implemented programs requiring these sources to obtain plan approval and operating permits. Air Management Services of Philadelphia operates a similar program for Philadelphia County sources. After the Clean Air Act of 1970, EPA began issuing New Source Performance Standards for major new sources of pollution. Pennsylvania has adopted these by reference.

The national programs also address toxic pollutants, many of which are VOCs. A listing of the Maximum Available Control Technology (MACT) regulations for toxic pollutants, National Emission Standards for Hazardous Air Pollutants (NESHAPS) and New Source Performance Standard (NSPS) regulations for new sources can be obtained from the Environmental Protection Agency. These federal programs have also been incorporated by reference into the Department's regulations.

Area Sources. The CAAA required EPA to adopt regulations for many area sources of VOC emissions, including the following:

Architectural and Industrial Maintenance (AIM) Coatings. These coatings are applied in the field by industry, contractors and homeowners to paint buildings, highway surfaces and industrial equipment for decorative and specialty coatings. VOC emissions result from the evaporation of solvents from coatings during application and drying. The AIM program involves product reformulation.

Autobody Refinishing. These are typically shop-applied coatings used by industry, small businesses and vehicle owners to repair vehicles. Emissions result from preparing the surface, applying the coating and cleaning equipment. The EPA measure targets reformulation of the coatings.

Consumer Products. EPA's regulations will require reformulation of 24 categories of personal care and household/car care products to reduce VOC emissions. EPA targeted those products with particularly high volatility. Examples are insecticides, adhesives, air fresheners, and cleaning products.

In addition, the federal Resource Recovery and Conservation Act regulated **treatment, storage and disposal facilities** (TSDFs) for hazardous wastes containing VOCs. The final phase of these regulations was effective on December 8, 1997.

Mobile (Highway and Nonroad) Sources. EPA's national (outside California) programs for controlling emissions from new motor vehicles and fuels have been very effective in reducing emissions of ozone precursors. In addition, EPA is working with vehicle/equipment manufacturers to regulate heretofore unregulated vehicles/equipment and to tighten existing rules. Since these strategies are in various stages of development and implementation, they have been summarized in *Figure 2.*

Federal Motor Vehicle Control Program and Tier I Vehicle Emission Standards. EPA began regulating tailpipe emissions of VOC and NO_x (and carbon monoxide) soon after the Clean Air Act of 1970. Because a significant amount of emissions also comes from evaporation of fuel during operation and refueling, regulation of evaporative emission systems soon followed. The most recent phase of light-duty vehicle regulation was phased in from 1994 to 1996 and includes more stringent exhaust emission and evaporative standards. With the implementation of the National Low Emission Vehicle program, even lower emitting vehicles will be available throughout the Northeast with 1999 model year vehicles and throughout the country with 2001 model year vehicles. Finally, EPA is considering more stringent Tier II national standards which could be implemented as early as the 2004 model year.

Reformulated Gasoline. Gasoline sold in the Philadelphia nonattainment area since late 1994 has been reformulated by the refinery to reduce VOC and toxic emissions by 15% over baseline levels. A second phase, due to begin in 2000, will further reduce VOC emissions and also reduce NO_x emissions. Use of reformulated gasoline reduces emissions from vehicles, nonroad gasoline-powered equipment such as lawnmowers and from evaporation at service stations.

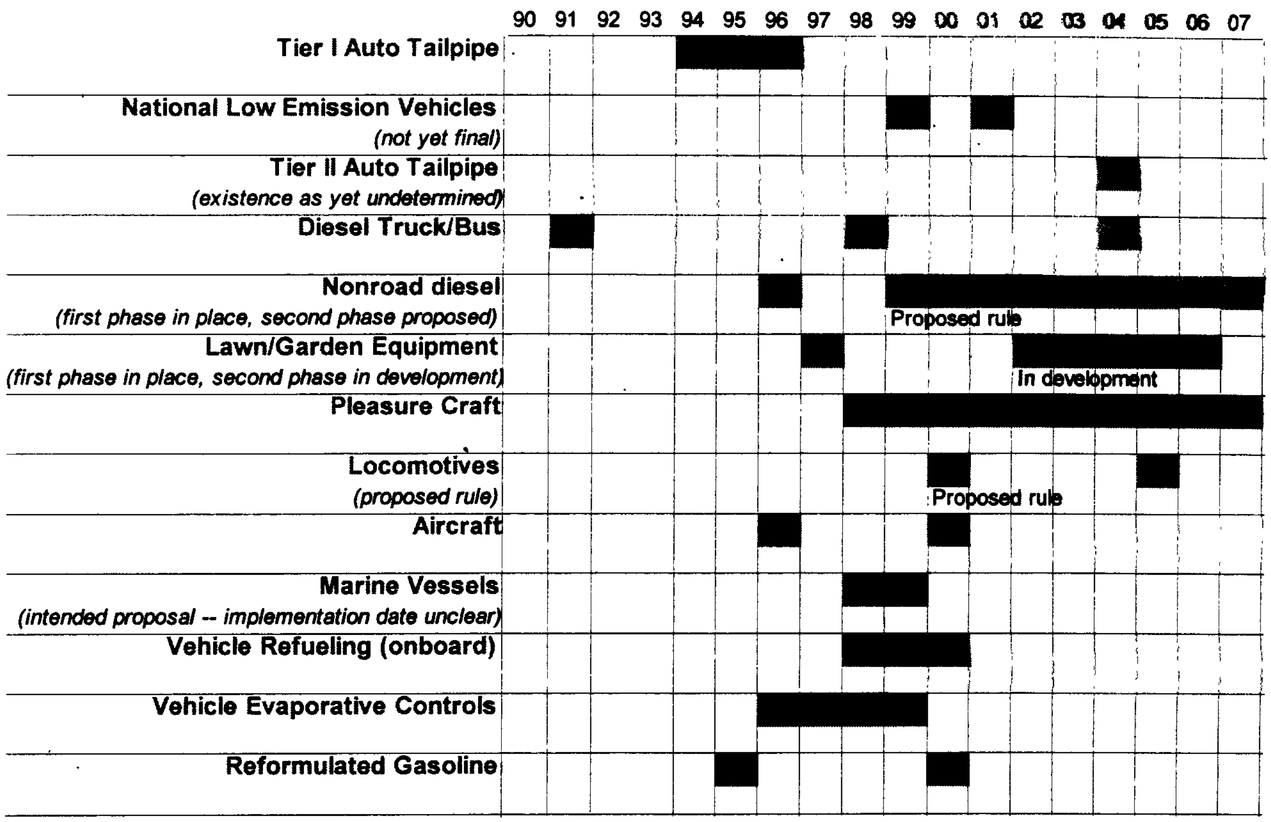
On-board refueling controls. EPA is requiring systems on newly manufactured light-duty cars and trucks which capture refueling emissions. The program is being phased in between model years 1998 and 2006.

Diesel Trucks, Buses and Fuels. Most of the heavy vehicles in the United States are powered by diesel engines, including heavy over-the-road trucks, school and municipal buses, construction vehicles that may or may not travel on roads, industrial equipment such as agricultural tractors. Lower polluting diesel fuel was required for highway vehicles nationwide. Initial emission standards for both highway and nonroad vehicles are in place; tighter standards are expected over the next decade. Municipal buses must meet tighter standards if their engines are rebuilt.

Other nonroad sources. Some emission reductions have already been achieved for lawn and garden equipment, both handheld (ex. trimmers) and nonhandheld (mowers). EPA has proposed additional standards, primarily affecting larger equipment. Standards for newly manufactured small boat engines are in place, while standards for commercial vessels are in development. EPA has proposed emission limits for locomotives.

Figure 2:

Start Dates for National Mobile Source Control Programs



EPA Office of Mobile Sources (recreated by DEP)
December 8, 1997

3.1.3 Regulatory Measures Under Consideration By Pennsylvania

The Southeast Ozone Stakeholders Group recommended a number of measures for consideration in Pennsylvania. A copy of the full report by the Stakeholders is available from the Department. These recommendations are currently under review and several are currently being further developed by the Department. The regulatory recommendations include:

- opting into the **National Low Emission Vehicle (NLEV)** program or, in the absence of NLEV, a state Low Emission Vehicle program. The federal program, now in effect, will require cleaner vehicles to be produced and sold in many Northeast states starting with the 1999 model year and the 2001 model year outside the Northeast and California. (MA, NY, ME and VT have or will have similar state programs.) Pennsylvania submitted its opt-in letter to EPA on January 30, 1998. Regulations to opt Pennsylvania into the national program were proposed on November 29, 1997. Pennsylvania plans to finalize its NLEV regulation in late 1998. By 2005, this program is expected to reduce VOC emissions by 11.5 tpd and NO_x emissions by 13.5, according to the Southeast Ozone Stakeholders report.

- regulations to establish permitting requirements, pollution prevention and work practice standards for **automobile repair and refinishing operations** as well as maximum VOC content levels for automobile refinishing materials. These regulations are proposed to be effective statewide. Proposed regulations were approved by the Environmental Quality Board on January 20, 1998. A final regulation is planned to be submitted to EPA by February 1999.

Regulations are under development to reduce VOC emissions from **solvent cleaning** operations not presently regulated by the provisions of Chapter 129. DEP anticipates presenting proposed regulations to the EQB after review by the Department's Air Quality Technical Advisory Committee.

The other regulatory recommendations under DEP's authority include:

- statewide Phase III NOx reductions for utility boilers as described in the NO_x MOU. The schedule for considering this measure is discussed in the Phase I plan.
- expanding emission controls to some boilers, process heaters and other combustion units not currently included in the NO_x MOU.
- NO_x control technologies such as selective catalytic reduction (SCR), selective non-catalytic reduction (SNCR) or low emission combustion technology to reduce emissions from stationary internal combustion engines to at or below 2 grams/brake horse power hour, except emergency generators, unless they are used primarily during high ozone days.

The stakeholders also recommended that the state implement an emission reduction credit trading program to harness market mechanisms and to encourage innovation and competition in the private sector to achieve emission reductions.

3.1.4 Emission Levels 2005 and Beyond

As described above, measures to reduce both VOCs and NOx are in various stages of development. Emission reductions from these measures, if fully implemented, would be significant. This section estimates what Pennsylvania's emissions would be if these measures are adopted and fully implemented. (Pennsylvania is not taking credit for or committing to adopt these measures as part of this SIP revision.)

Some measures, once adopted, might have become "fully implemented" rapidly. An example is a control written into a permit for a stationary source. However, some measures by their nature will take longer to become "fully implemented," even though they may have already been adopted. Most significantly, tailpipe emission standards for new vehicles (such as federal Tier 1 standards or the National Low Emission Vehicle program) are fully implemented when the only vehicles operating in Pennsylvania are those designed to meet that standard -- that is, when virtually all older vehicles have been replaced by cleaner vehicles.

Any projection of emission levels in Pennsylvania as a result of full implementation of anticipated measures will contain inaccuracies due to such factors as lack of known specificity in control levels, lack of established calculation methodologies, the need to rely on national figures and difficulties in long-term economic growth projections. Therefore, in making the estimate below, economic/population growth was **not** taken into account -- uncontrolled emissions are assumed to be at 2005 levels for future years. National percentage reduction figures provided by EPA are used for Pennsylvania.

In 2005, the strategies for which Pennsylvania takes credit in the Rate-of-Progress Plan result in a total inventory of 428 tpsd of VOCs and 317 tpsd of NOx. Full implementation of other anticipated strategies could reduce those emissions to 388 tpsd of VOCs and 208 tpsd of NOx. (Again, no credit is being taken in this SIP revision) Strategies included in this estimate are additional reductions from nonroad sources (both small spark ignition engines and large diesel vehicles), the National Low Emission Vehicle program as well as any strategy used to meet the NOx budget provisions of EPA's proposed rule for interstate ozone transport reduction. (Point source recommendations of the Southeast Pennsylvania Ozone Stakeholder Working Group affecting combustion units and stationary internal combustion engines could be used to meet these NOx budget provisions, so they were not considered separately.)

Figures 3a and 3b present this information by sector. They compare the baseline inventory ("1990"), what the inventory would be without controls mandated by the 1990 CAAA ("2005 uncontrolled"), the inventory after measures for which credit is claimed in the ROP plan ("2005 SIP") and the inventory after full implementation.

Figure 3a:

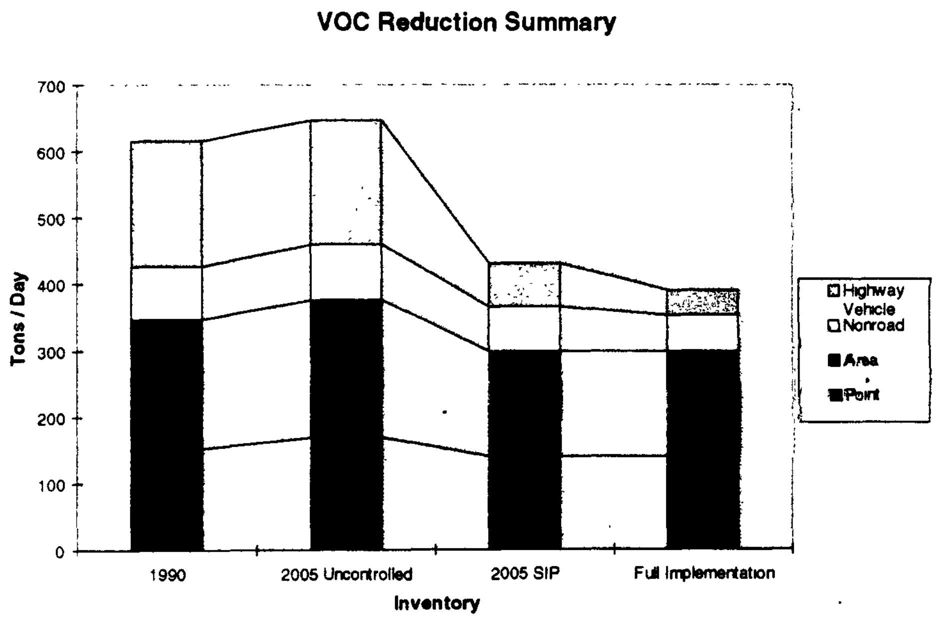
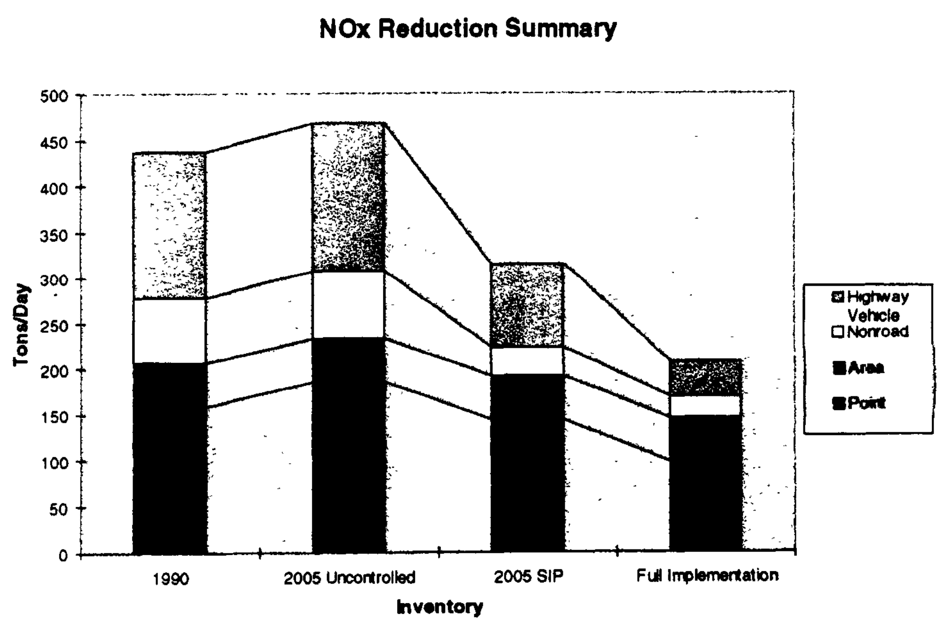


Figure 3b



3.2 Rate of Progress Plans

As required, the Commonwealth will reduce VOC emissions by at least 42% between 1990 and 2005. Fifteen percent of those reductions were required to be accounted for in Pennsylvania's 15% Plan which was submitted to EPA on September 12, 1996. Nine percent of those reductions must occur between 1996 and 1999 and are documented in the separate Phase I submission.

This section contains a demonstration that with certain control strategies, the Philadelphia nonattainment area meets the CAAA's Rate of Progress (ROP) plan requirements by reducing VOC emissions by 3% annually from 1999 to 2005. Pennsylvania's plan, as required, also reduces emissions enough to account for any emissions growth that occurs in those years. The chapter includes summary information on the 1990 inventory from which these required reductions must be calculated. This section indicates those regulatory measures (described previously) on which the Commonwealth is relying to obtain the required emission reductions and provides information on how those quantified reductions affect the emissions inventory. ROP calculations are included in Appendix III for two milestone years, 2002 and 2005.

3.2.1 1990 and "Uncontrolled" Inventories

An ozone emissions inventory represents those ozone precursor emissions that are produced and emitted to the air during the "peak" ozone season – the time of year when pollutants and meteorology are most likely to interact in such a way that high concentrations of ground-level ozone are created. Pennsylvania's peak ozone season occurs during the summer months. Unless otherwise specified, all daily emissions given refer to a "typical" summer weekday, and are given in tons per summer day (tpsd).

An emissions inventory is a compilation of the emissions from sources of anthropogenic (human-made) sources of oxides of nitrogen (NO_x), and volatile organic compounds (VOCs) into the outdoor air. The sources are categorized into four components:

- *Point Sources* – utilities, industries, and other facilities that emit more than a certain amount of VOCs or NO_x per year
- *Area Sources* – industrial/commercial sources too small or too numerous to be handled individually such as solvent use, some waste disposal, and other categories
- *Nonroad Engine Sources* – construction and agricultural equipment, recreational boats, lawnmowers, and similar sources
- *Highway Vehicle Sources* – cars, trucks, buses, and motorcycles

While natural (*biogenic*) sources such as vegetation do play a role in the formation of ground-level ozone and are accounted for in air quality modeling, they are not included in the SIP inventory because no reductions can be made from these types of sources.

1990 Inventory

The "base year" inventory is for calendar year 1990, the year the CAAA were enacted.

Figure 4a: 1990 VOC Emissions

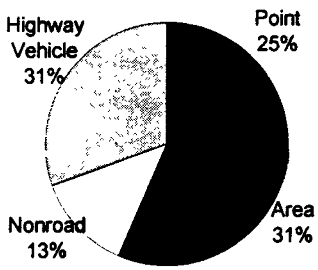
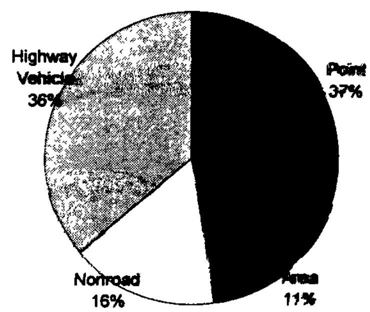


Figure 4b: 1990 NOx Emissions



Methodologies. A detailed description of the method used to compile the point source list and a description of the emissions estimation procedure are contained in the 15% ROP Plan. Emissions were adjusted for seasonal variability and rule effectiveness. The EPA-approved methodology used to calculate each area source category is included in Appendix III of the 15% ROP Plan. The Philadelphia nonroad estimate was drawn from spreadsheets prepared by EPA's Office of Mobile Sources for the Philadelphia area. Highway vehicle emission estimates were coordinated with the Pennsylvania Department of Transportation (PennDOT). The data and methods presented in the inventory represent the Commonwealth's approach based on EPA guidance. The MOBILE Model, the only methodology approved by EPA to calculate highway vehicle emissions, is used for calculating emissions factors, supported by the Post Processor for Air Quality (PPAQ). MOBILE Version 5a_H was the primary version used. (MOBILE Version 5b was used to calculate reductions from Phase 2 Reformulated Gasoline.) Additional discussion of PPAQ and MOBILE modeling can be found in Appendix III and the 15% ROP Plan.

Uncontrolled Inventories

Due to many factors – such as population increase, increases in spending and industrial production, increases in the number of miles people drive every year, and other factors – emissions would grow if left unchecked. In order to meet air quality goals, the emission reduction plan must also offset the expected growth in VOC emissions between

1999 and 2005. As a result, the total reduction necessary from 1996 emissions is actually greater than 3% per year.

Uncontrolled Inventories are estimates of VOC emissions which would be expected in milestone years if no new additional regulatory strategies were implemented after 1990.

Methodologies. EPA has provided guidance for how growth is to be calculated. DEP's methodology, growth factors and how the growth factors were applied to the emissions inventory are documented in Appendix III. In summary:

- Growth in the point source inventory was calculated based on growth in income by two-digit Standard Industrial Classification (SIC) code and then multiplying the appropriate inventory by each growth factor.
- With the exception of gasoline marketing operations, the area source and nonroad inventories were projected from US Bureau of Economic Analysis data, based on employment and population emission factors.
- Highway vehicle emissions growth and, in the area source category, gasoline marketing growth, are projected based on the projected increase in Vehicle Miles Traveled (VMT). This projection was derived from a Traffic Demand Model (TDM) and the Post Processor for Air Quality (PPAQ).

Tables 3a and *3b* and *Figures 5a* and *5b* project what emissions would be for each milestone year to 2005 *if no post-1990 emission controls were in effect.* These inventories are called "uncontrolled" inventories.

Table 3a: VOC Emissions Before Controls (in tpsd)

	1999	2002	2005
Point	162	166	169
Area	203	205	207
Nonroad	83	83	84
Highway Vehicle	177	180	187
Totals	625	634	647

Table 3b: NOx Emissions Before Controls (in tpsd)

	1999	2002	2005
Point	177	182	187
Area	47	47	47
Nonroad	74	75	75
Highway Vehicle	156	157	160
Totals	455	461	469

Figure 5a:

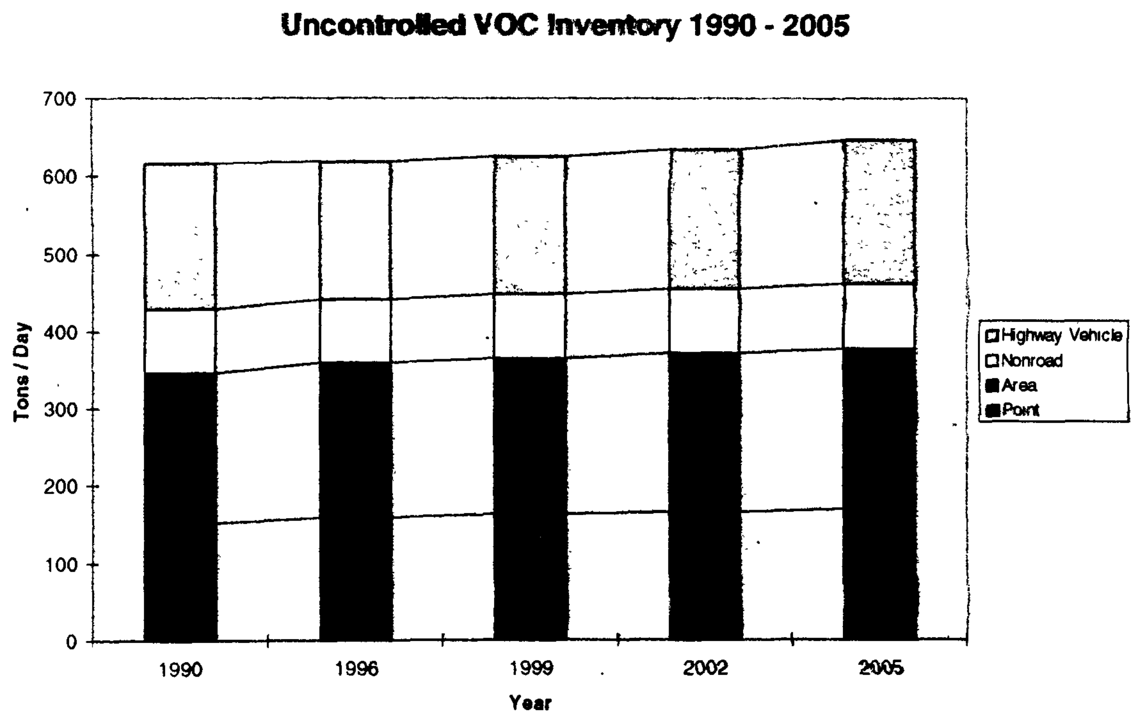
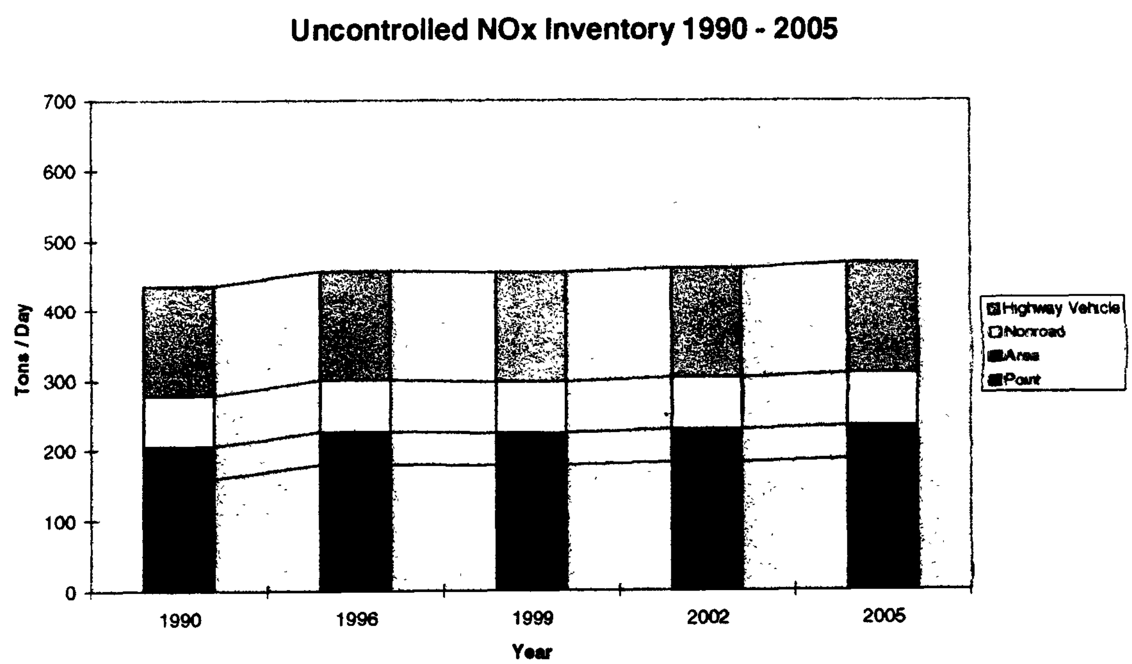


Figure 5b



3.2.2 Milestone Year Emission Target Levels

The Clean Air Act Amendments require that serious and above areas continue to reduce VOC emissions annually by 3% until the area has attained the standard. States must also reduce emissions enough to account for any emissions growth that occurs between 1990 and each milestone year. The process by which states must calculate these reductions is not simple. It is neither 3% of a constant amount per year nor 42% (3% times 14 years from 1990 to 2005) of the 1990 inventory because it must account for certain statutory provisions:

- The 3% per year is calculated over a period of three years (that is, it need not be recalculated on an annual basis), called milestone years (1999, 2002 and 2005).
- States cannot take credit for certain motor vehicle reductions put in place before 1990. Since emission reductions associated with the FMVCP increase each year due to fleet turnover, an adjusted baseline year level must be recalculated for every milestone year.

The number of tons that must be reduced for each milestone year is calculated by:

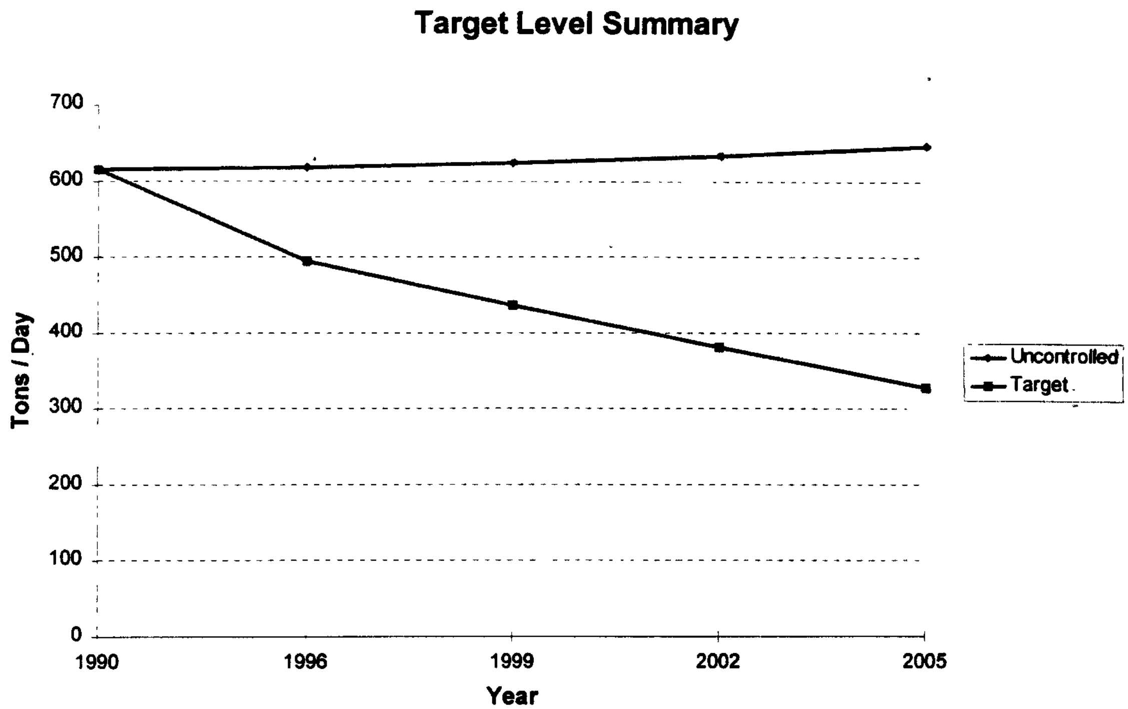
- adjusting the 1990 inventory as explained above;
- determining a maximum target level by applying the appropriate percentage reduction and adjustments;
- projecting the 1990 inventory based on economic factors to determine its level in a milestone year if no new controls were in place (uncontrolled projected inventory);
- determining the difference between where the area should be (target level) and where it would have been without controls (uncontrolled projected inventory).

While NOx control measures can be substituted for VOC control measures to demonstrate compliance with post-1996 percentage reduction requirements, the calculation of emission target levels is done using VOC inventories only. NOx reductions must be expressed in terms of VOC-equivalent reductions for purposes of demonstrating compliance with the reduction requirements.

EPA has developed the methodology by which states must calculate emission reductions (discussed in Appendix III.) The results of these calculations for the Philadelphia Area are summarized below and included in more detail in Appendix III. The projected emissions for 2002 must be less than or equal to 381 tpsd. The projected emissions for 2005 must be less than or equal to 328 tpsd.

Figure 6 indicates the required decreases from 1990 to 2005, which is Southeast Pennsylvania's statutory attainment date.

Figure 6:



Milestone Year 2002 and 2005. The 2002 target level of emissions is 381 tpsd. Projected uncontrolled emissions for 2002 are 634 tpsd – a difference of 254 tpsd. The 2005 target level of emissions is 328 tpsd. Projected uncontrolled emissions for 2005 are 647 tpsd – a difference of 319 tpsd. Therefore, in order to meet the ROP requirements, Pennsylvania must demonstrate VOC-equivalent reductions of at least 254 tpsd in 2002 and 319 tpsd in 2005.

3.2.3 Control Strategies in ROP Plans

Pennsylvania will reduce emissions from the strategies listed in *Tables 4a* and *4b* with the VOC and NO_x reductions expected. Synopses of these control measures were provided in Section 3.1 and are discussed in Appendix III in more detail.

Table 4a: VOC Reduction Measures By Year (1996-2005)

	1996	1999	2002	2005
Fed. Motor Vehicle Control Program	0	6.92	13.06	20.38
Enhanced Vehicle Inspection/Maintenance	0	59.28	62.04	66.14
Fed. Reformulated Gasoline	0	22.41	35.17	36.19
Reasonably Available Control Technology (RACT)	6.81	9.82	10.11	10.42
Rule Effectiveness for Point Sources	18.97	15.93	16.17	16.45
Shutdowns	2.00	2.38	2.59	2.79
Fed. Architectural/Industrial Maintenance Coatings	7.28	7.33	7.38	7.43
Fed. Autobody Refinishing	5.96	6.01	6.07	6.12
Fed. Consumer Products	6.58	6.64	6.71	6.77
Stage II Vapor Recovery /Fed. On-board Controls	16.83	17.71	19.82	21.25
Fed. Waste Treatment, Storage Disposal Facilities	9.43	9.52	9.61	9.70
Fed. Spark Ignition (Small Nonroad) Engines	0.00	0.00	0.00	15.79
Total (Rounded to nearest ton)	74	164	189	219

Table 4b: NOx Reduction Measures By Year (1996-2005)

	1996	1999	2002	2005
Fed. Motor Vehicle Control Program		14.84	23.38	28.13
Enhanced Vehicle Inspection/Maintenance		32.29	32.77	33.94
Fed. Reformulated Gasoline		0.43	5.74	5.40
Reasonably Available Control Technology (RACT)		5.63	5.74	5.82
Rule Effectiveness for Point Sources		0.00	0.00	0.00
NOx Allowance Requirements		27.37	30.82	34.20
Shutdowns		1.47	1.21	0.94
Fed. Compressed Ignition (Diesel Nonroad)I Engines		0.00	0.00	44.00
Total (Rounded to nearest ton)		82	100	[illegible]

(NOTE: NOx controls were not creditable in 1996.)

Emissions of VOC and NOx after these controls are applied are summarized in *Tables 5a-b* and *Figures 7a* and *7b*.

Figure 7a:

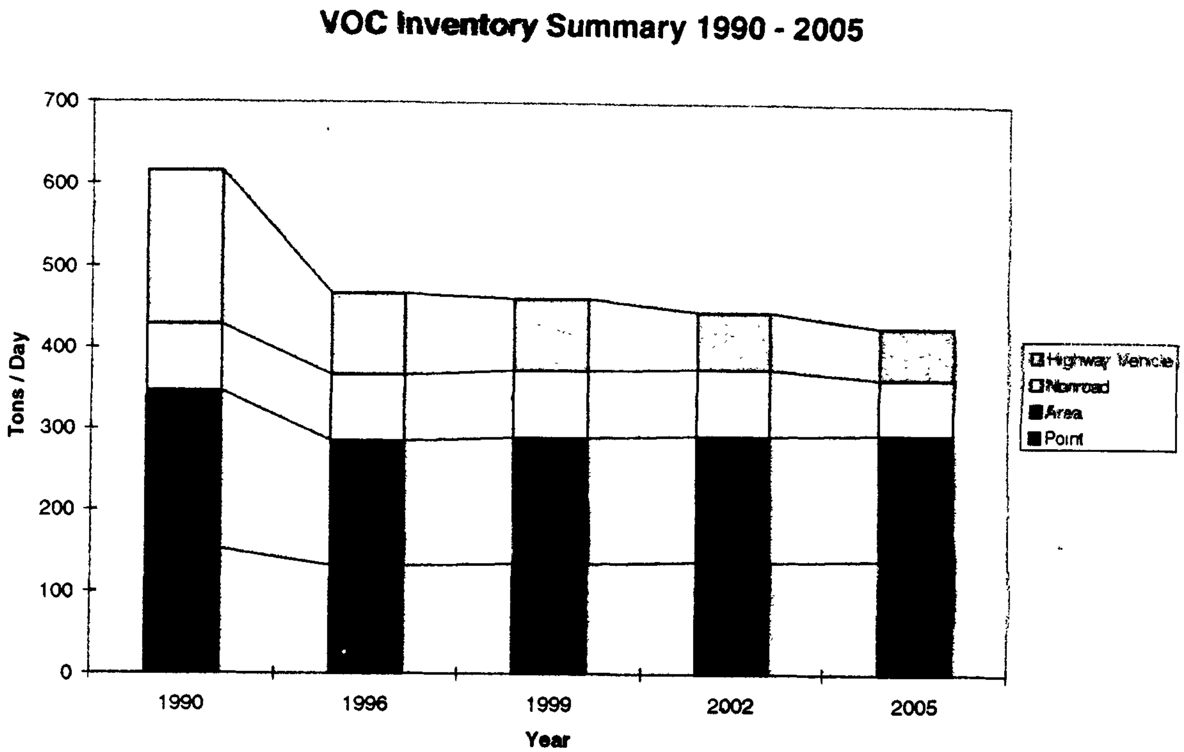


Figure 7b:

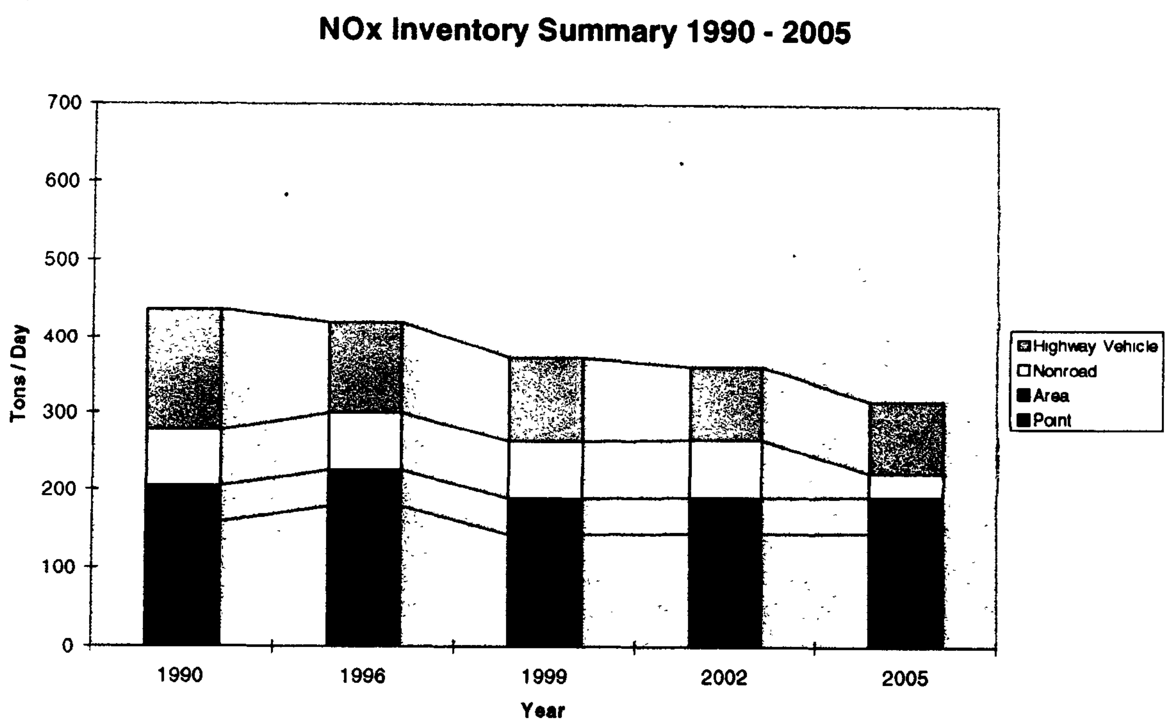


Table 5a: VOC Emissions After Controls (in tpsd)

	1999	2002	2005
Point	134	137	139
Area	156	156	156
Nonroad	83	83	68
Highway Vehicle	88	70	64
Totals*	**461**	**446**	**428**

Table 5b: NOx Emissions After Controls (in tpsd)

	1999	2002	2005
Point	143	144	146
Area	47	47	47
Nonroad	74	75	31
Highway Vehicle	109	95	93
Totals*	**373**	**362**	**317**

*** Rounded to nearest ton after calculation**

Post-1996 reductions in NO_x can be substituted for a portion of the required VOC reductions. All reductions must be reported in tons of VOCs, so the NO_x reductions must be converted to "VOC-equivalent" tons. For the milestone years, one ton of NO_x is "worth" 1.37 tons of VOC. Therefore, for example, the 152 tpsd of NOx reduction achieved in 2005 is "worth" 209 tpsd of VOCs. The methodology to establish the VOC/NOx Ratio and thus convert the NOx reduction to a creditable VOC reduction is contained in Appendix III.

The reductions Pennsylvania achieves will more than meet the ROP requirement, summarized in *Figure 1* (repeated here from the Executive Summary for the reader's convenience) and *Table 6.* In 2002, Pennsylvania achieves 326 VOC-equivalent tpsd of reductions (254 tpsd required). In 2005, Pennsylvania achieves 429 VOC-equivalent tpsd of reduction (319 tpsd required).

(Figure 1)

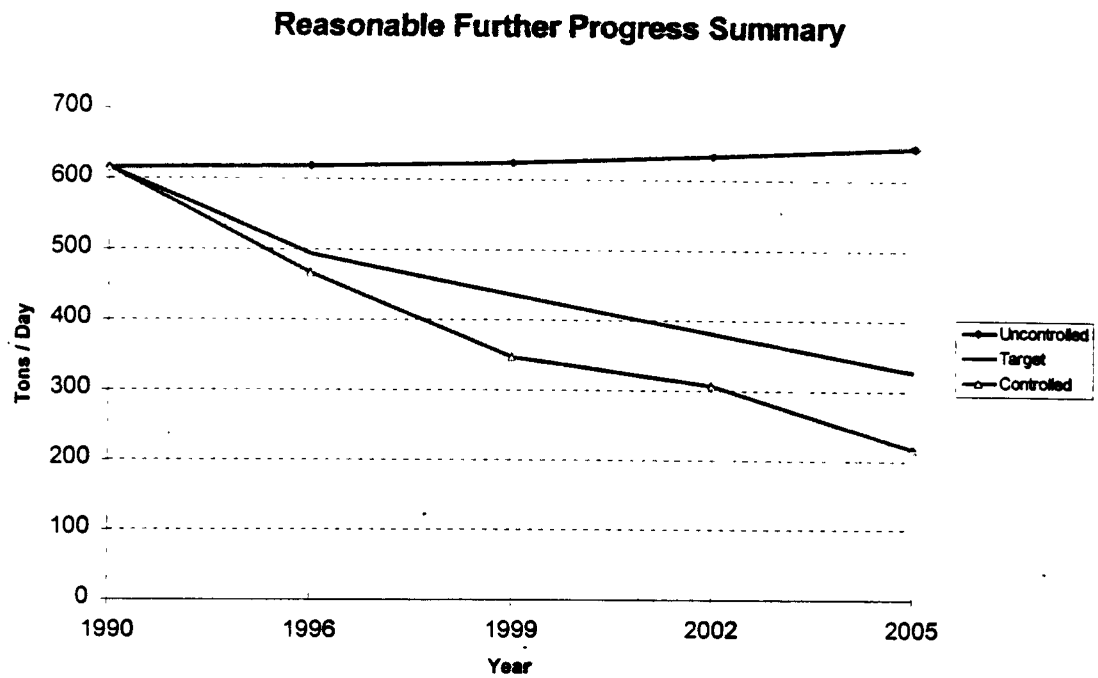


Table 6: Rate of Progress Summary (in tpsd)

	1996*	1999	2002	2005
Uncontrolled	618	625	634	647
Target Level	494	436	381	328
Controlled VOC-Equivalent	467	348	309	218

*** Provided for information - documented in previous SIP revisions.**

3.3 Transportation Conformity

The federal Clean Air Act Amendments (Section 176c) provide a mechanism by which federal funded or approved highway and transit plans, programs and projects are determined not to produce new air quality violations, worsen existing violations or delay timely attainment of national air quality standards. EPA has promulgated regulations (40 CFR Part 51.390 and Part 93.100-128) which set forth procedures to determine that transportation plans, programs and projects "conform" to SIPs. In November 1994, Pennsylvania submitted a revision to its SIP that implemented transportation conformity in the affected areas of the Commonwealth, including the Philadelphia Ozone Nonattainment Area.

EPA's transportation conformity rule provides that the motor vehicle emission "budgets" establish caps on motor vehicle-related emissions which cannot be exceeded by the predicted transportation system emissions in the future. Motor vehicle emission budgets are the emissions from highway vehicles after anticipated controls for a milestone year. EPA's regulations provide that emissions inventories submitted with a control strategy SIP (such as this Rate-of-Progress Plan) may establish a budget for conformity purposes even before the SIP itself is approved by EPA. The emission budgets established by this document are based on the projections in Table 7:

Table 7: VMT and Average Speeds

	1990	**1999**	**2002**	**2005**
Vehicle Miles Traveled	64,602,389	74,749,703	77,227,100	79,712,326
Average Speed	25.2	23.9	23.5	23.0

The motor vehicle emission budgets for the future milestone years are shown in Table 4. Budgets are established in kilograms because transportation conformity projections have been traditionally projected in kilograms. Tons per day are provided for the reader's convenience only and have been rounded to the nearest ton.

Table 8: Motor Vehicle Emission Budgets for Transportation Conformity

POLLUTANT	**1999**	**2002**	**2005**
VOC			
- kilograms/summer day	80,056	63,558	58,271
- tons/ summer day	88	70	64
NOx			
- kilograms/summer day	98,739	91,354	88,614
- tons/summer day	109	95	93

The following information is available in Appendix III - Part H to document establishment of the highway vehicle emissions inventories and the transportation conformity emission budgets:

- Summary tables by county: VMT and speeds; VOC/NOx emissions for baseline, adjusted baseline and control strategy inventories
- Vehicle Emission Inspection Maintenance Program Modeling Parameters
- Control strategy emissions component breakouts by county
- Emissions by road functional class
- Emissions by county by vehicle type
- Sample MOBILE input files
- Sample MOBILE output files

4. Air Quality Monitoring

4.1 Summary of Findings

Monitoring data from the Philadelphia region show ozone concentrations declining over the 1974-97 time period. The Philadelphia Interstate Ozone Nonattainment Area design value determined from the monitor data has declined 48% from 1976 to 1997. The Philadelphia Interstate Ozone Nonattainment Area's current design value is 134 ppb (standard is effectively 124 ppb). Both of these figures exclude the recently established Fairhill, MD monitor. Ozone concentrations at individual monitors within the Philadelphia Interstate Ozone Nonattainment Area declined over the 1974-97 sampling period. Peak one-hour ozone concentration declines ranged from 49% to 13%. Annual 4th high concentrations declines ranged from 43% to 9% at various monitors within the Philadelphia Interstate Ozone Nonattainment Area.

Declines in ozone concentration values occur at monitors upwind and downwind of the City of Philadelphia. Recent data indicate ozone concentrations upwind of Philadelphia are higher than ozone concentrations downwind of Philadelphia. This result suggests further controls and reductions are needed in upwind regions in order to reduce ozone and ozone precursor transport into the Philadelphia Interstate Ozone Nonattainment Area.

The largest reductions in ozone concentrations occur at the monitors closest to the City of Philadelphia. This indicates that a large segment of the population has experienced a substantial improvement in air quality over the past twenty-four years. Summer temperatures do not appear to alter the overall downward trend in the Philadelphia Interstate Ozone Nonattainment Area's ozone concentrations.

Air quality monitoring data indicate emission reduction programs have been effective and made substantial progress in lessening the extent and severity of ozone concentrations across the area. Furthermore, declining ozone concentrations in the Philadelphia Ozone Nonattainment Area provide a compelling "weight of evidence" argument that current NOx and VOC controls are leading the area towards attainment.

4.2 Overview of Trend Analysis

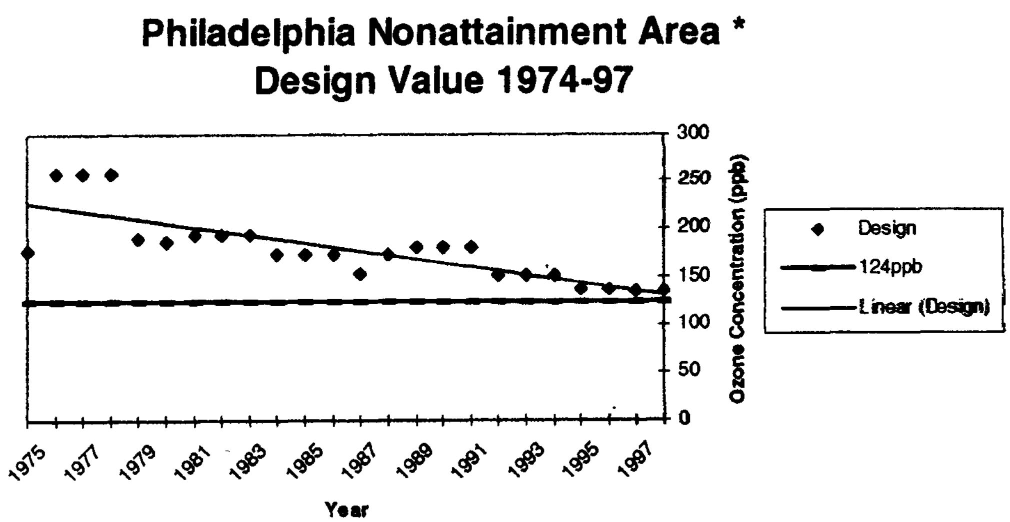
DEP prepared ozone trend analyses for the Philadelphia Interstate Ozone Nonattainment Area over the 1974-97 time period. *Map 1* shows the Philadelphia Interstate Ozone Nonattainment Area, which encompasses fourteen counties in the states of Pennsylvania, New Jersey, Delaware, and Maryland. A total of 36 monitors have operated in the Philadelphia Interstate Ozone Nonattainment Area from 1974 to 1997. Of these, only eight monitors have roughly continuous data over the 1974-97 time period. Five of these monitors are in Pennsylvania, and three are in New Jersey.

The department completed peak and 4th high one-hour ozone concentration and design value trend analyses for a number of different monitor groups. These groups included the Philadelphia Interstate Ozone Nonattainment Area monitors, monitors located upwind of Philadelphia, and monitors located downwind of Philadelphia. An attempt was also made to examine the effects of "warm" and "cool" summers on monitor trends. Trend analyses conducted on the different monitor groups show ozone concentrations in the Philadelphia region are generally declining. The only exception is the Cecil County, MD monitor (Fairhill, est. 1992) where ozone concentrations appear to be rising. With this possible exception, air quality in the Philadelphia region has improved significantly since 1974.

4.3 Ozone Trend: Philadelphia Area 1974-97 Design Values

The design value is the 4th highest one-hour ozone concentration over three years. The Philadelphia Interstate Ozone Nonattainment Area's design value is the highest design among the 36 monitors that operated within the Philadelphia Interstate Ozone Nonattainment Area from 1974-97. *Figure 8* shows the area's design values and corresponding trend line. The Philadelphia Interstate Ozone Nonattainment Area's design value has declined from 257 ppb in 1976 to 134 ppb in 1997, a decrease of 48%. This figure excludes the recently established Fairhill, MD monitor. Including this monitor increases the area's design value to 145 ppb.

Figure 8: Philadelphia Interstate Ozone Nonattainment Area's maximum design values and fitted trend line, 1974-97.

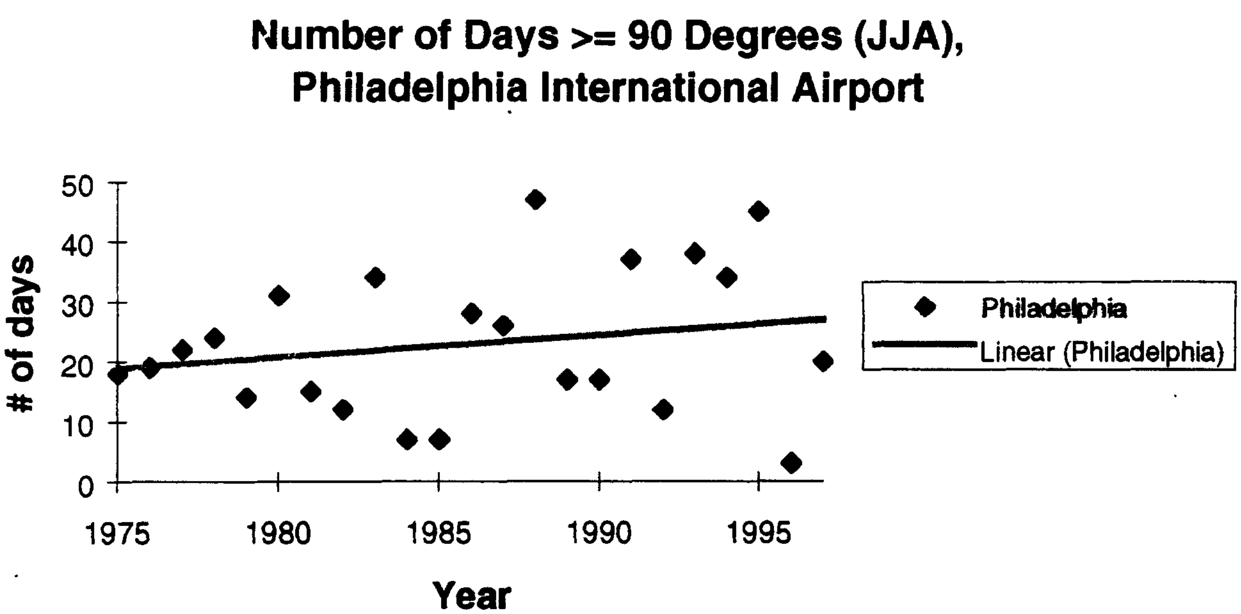


* *Does not include Fairhill, MD*

4.4 Ozone Trend: Warm Summers vs. Cool Summers

The overall downward trend in the Philadelphia region's ozone concentrations did not appear to be affected by differences in summer temperatures. To determine if summer temperatures affected ozone trends, each summer was designated as warm or cool according to the number of 90-degree days measured at Philadelphia International Airport during June, July, and August. *Figure 9* shows the numb of 90 degree days measured at Philadelphia International Airport from 1975 to 1997. A linear trend is drawn for the 1975-97 time period. An average summer (June, July, August) during this time period had just under 23 days in which temperatures were greater than or equal to 90 degrees F. Summers experiencing more 90° days than average were designated "warm" and those experiencing fewer 90° days than average were designated "cool".

Figure 9: The number of June, July, and August 90 degree days at Philadelphia International Airport.



The highest 4th value within the Philadelphia Interstate Ozone Nonattainment Area declined over the 1975-97 time period for both warm and cool summers. The "cool summer's" 4th high declined more than "warm summer's" 4th high; 41% for cool summers vs. 29% for warm summers. Ozone trends at individual monitors showed the same patterns with declines for cool summers slightly greater than declines for warm summers. Graphs showing warm and cool summer trends are located in Appendix IV.

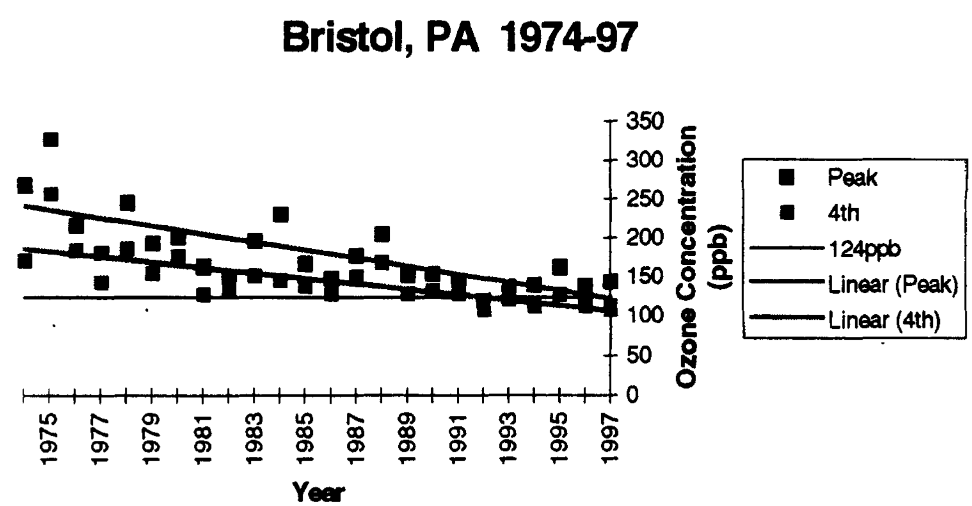
4.5 Ozone Trend: Peak Values vs. 4th Values

Declining ozone concentrations appeared in both peak and 4th high values. In general, peak one-hour values declined slightly more than 4th high values. *Table 9* summarizes peak and 4th high trends. Trends were calculated for eight sites in the Philadelphia region that had roughly continuous data over the 1974-97 time period. *Figure 10* shows peak and 4th high one-hour ozone concentrations for Bristol, PA. Bristol usually exceeds the standard during ozone exceedance episodes in Southeast Pennsylvania. For many of the past twenty-four years, it has the highest value of any Southeast Pennsylvania monitor. Note the peak trend line declines more than the 4th trend line. Graphs for the monitors listed in *Table 9* are located in Appendix IV.

Table 9: Peak and 4th-Highest Trends

1974-97	PEAK		4TH	
Site	**Decline**	**ppb/yr**	**Decline**	**ppb/yr**
Chester, PA	38%	-3.3	22%	-1.3
Bristol, PA	49%	-4.9	43%	-3.3
Norristown, PA	40%	-3.3	39%	-2.6
Roxborough, PA	39%	-3.3	39%	-2.6
N/E Philadelphia, PA	41%	-3.5	42%	-3.0
Camden, NJ	40%	-3.5	25%	-1.6
Ancora State Hospital, NJ	13%	-0.9	13%	-0.7
Mercer County, NJ	24%	-1.9	9%	-0.5

Figure 10: Peak and 4th highest one-hour values for Bristol, Pennsylvania with linear trend lines.



4.6 Ozone Trends: Upwind Monitors vs. Downwind Monitors

Typical wind directions during Philadelphia exceedances determine if a monitor is upwind or downwind of Philadelphia. Wind fields during exceedances in the Philadelphia region are typically from the west to southwest. Upwind monitors are therefore located west and southwest of Philadelphia. Conversely, downwind monitors are located east and northeast of Philadelphia. *Table 5* lists the monitors used to determine upwind and downwind trends and *Map 2* shows their location. The maximum peak and 4^{th} one-hour values for the 1974-97 time period were then plotted and analyzed.

Both the upwind and downwind monitors showed declines in peak and 4^{th} values. Upwind peak and 4^{th} values both declined by 23%. Downwind peak and 4^{th} values declined more than the upwind monitors, with peak values declining 46% and 4^{th} values declining 41%. *Table 10* lists the upwind and downwind monitor.

Figure 11 shows that trend lines for both upwind and downwind monitors reach approximately the same value in 1997. This result suggests ozone concentrations downwind of Philadelphia are roughly the same as those upwind of Philadelphia. Comparing actual peak one-hour and 4^{th} high values show ozone concentrations upwind of Philadelphia are actually higher than ozone concentrations downwind of Philadelphia. In fact, upwind ozone concentrations show a slight increase over the last five years. Both of these results are due to monitoring data from the recently established Fairhill, MD monitor.

Table 10: Upwind and Downwind Monitors

UPWIND MONITORS	DOWNWIND MONITORS
Norristown, PA	Bristol, PA
Fairhill, MD	Roxborough, PA
Killens Pond State Park, DE	N/E Philadelphia, PA
	Camden, NJ
	Ancora State Hospital, NJ
	Burlington County, NJ

Map 2: Philadelphia area ozone monitor locations.

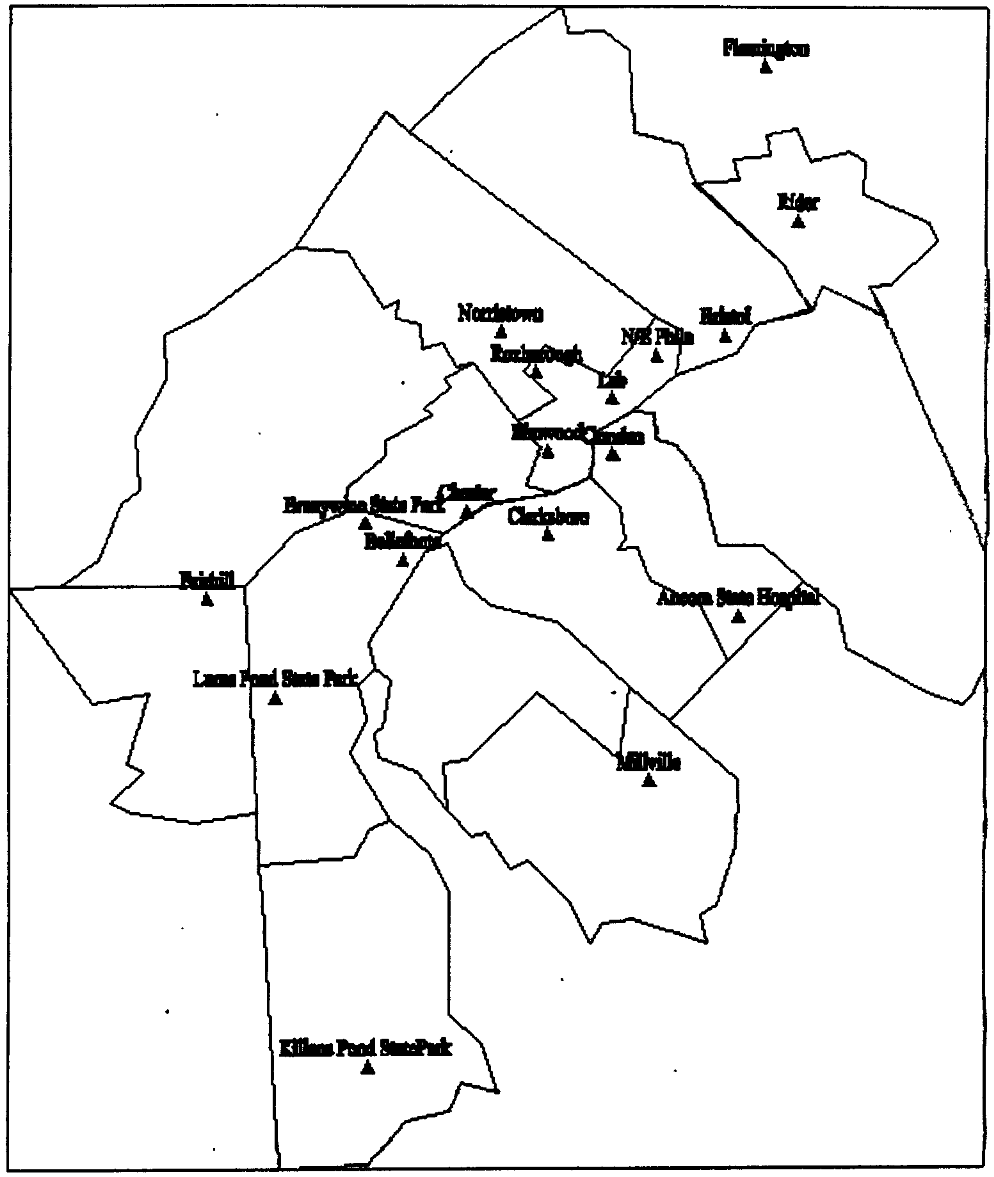
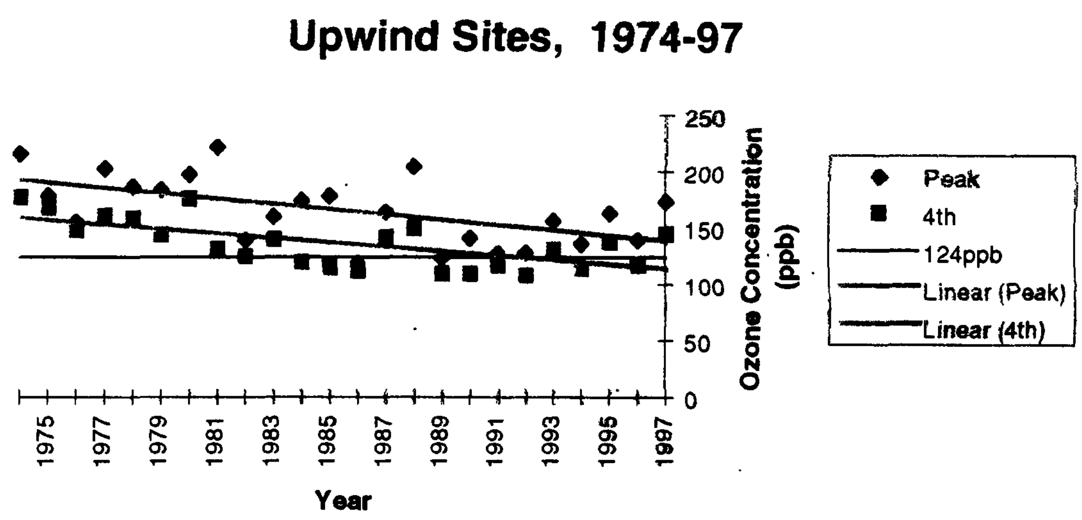
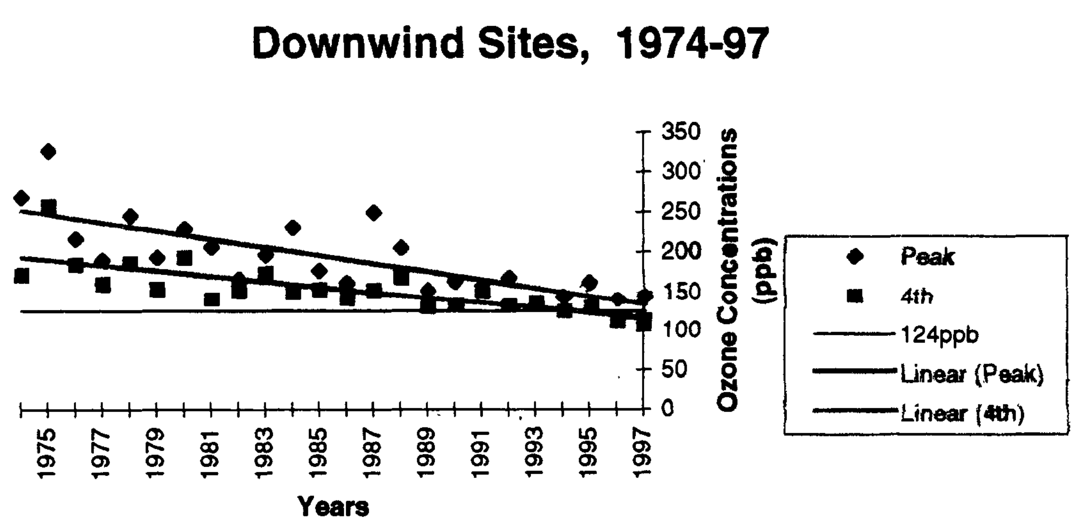


Figure 11: Peak one-hour values, 4th high values, and trend lines for monitors upwind and downwind of Philadelphia.





4.7 Ozone Trend: Distance from Philadelphia vs. Ozone Decline

Declines in ozone concentration appear to be tied to monitor distance from Philadelphia; the closer the monitor, the greater the decline in peak one-hour and 4th high values. Results from *Table 5* illustrate this point. Note that, with the exception of Norristown, the monitors closest to Philadelphia (Roxborough, N/E Philadelphia, Bristol, Chester, Camden) have larger declines in their peak one-hour and 4th high values than those further away from Philadelphia (Ancora State Hospital; Mercer County, NJ).

Similar results occur for two monitors in Delaware. *Table 11* lists peak one-hour and 4th high declines for New Castle and Kent counties. Declines at the monitor that is closer to Philadelphia (New Castle) are over twice as large as those at the monitor further from Philadelphia (Kent County).

Table 11. Comparison of Nearest/Farthest Monitors from Population Center

1997-80	PEAK		4TH	
Site	**Decline**	**ppb/yr**	**Decline**	**ppb/yr**
Kent County, DE	11%	-0.8	8%	-0.5
New Castle County, DE	28%	-2.9	25%	-2.1

5. Modeling

The federal CAAA require complex photochemical modeling for all serious and above nonattainment areas to demonstrate that the area will attain the one-hour health-related ozone standard. Photochemical ozone models are mathematical representations of the changes that occur when air pollutants are emitted into the atmosphere, travel downwind and, in the presence of sunlight, react photochemically to form ozone.

The geographical area included in the model encompasses multiple geopolitical boundaries (counties, local governments, and states) with a potentially large regulated community. Therefore, application of photochemical modeling requires coordinating a large number of technical and policy decisions in order to operate, interpret and use the model consistently.

5.1 How Models Operate

Two types of photochemical models are used which affect the Philadelphia nonattainment area. They differ primarily in the geographical area covered. One covers the immediate nonattainment area in detail. The other uses less detail for the broader area surrounding the nonattainment area and is used to develop air pollution levels at the boundary of the detailed nonattainment area.

The photochemical model currently approved by EPA for attainment area demonstrations is the fourth generation of the Urban Airshed Model (UAM IV). Other models are under development but are not as yet approved by EPA for this purpose. The model currently approved by EPA for regional attainment assessment, which also provides boundary concentration inputs for the UAM model is the Regional Oxidant Model 2.2 (ROM). This modeling was completed for the Northeast states by EPA and by a state/EPA/industrial cooperative called Modeling Ozone Cooperative Association (MOCA). More recently, models have been developed to handle both the local scale attainment area demonstrations while still including large regional areas. UAM V was one of the first of this type of models.

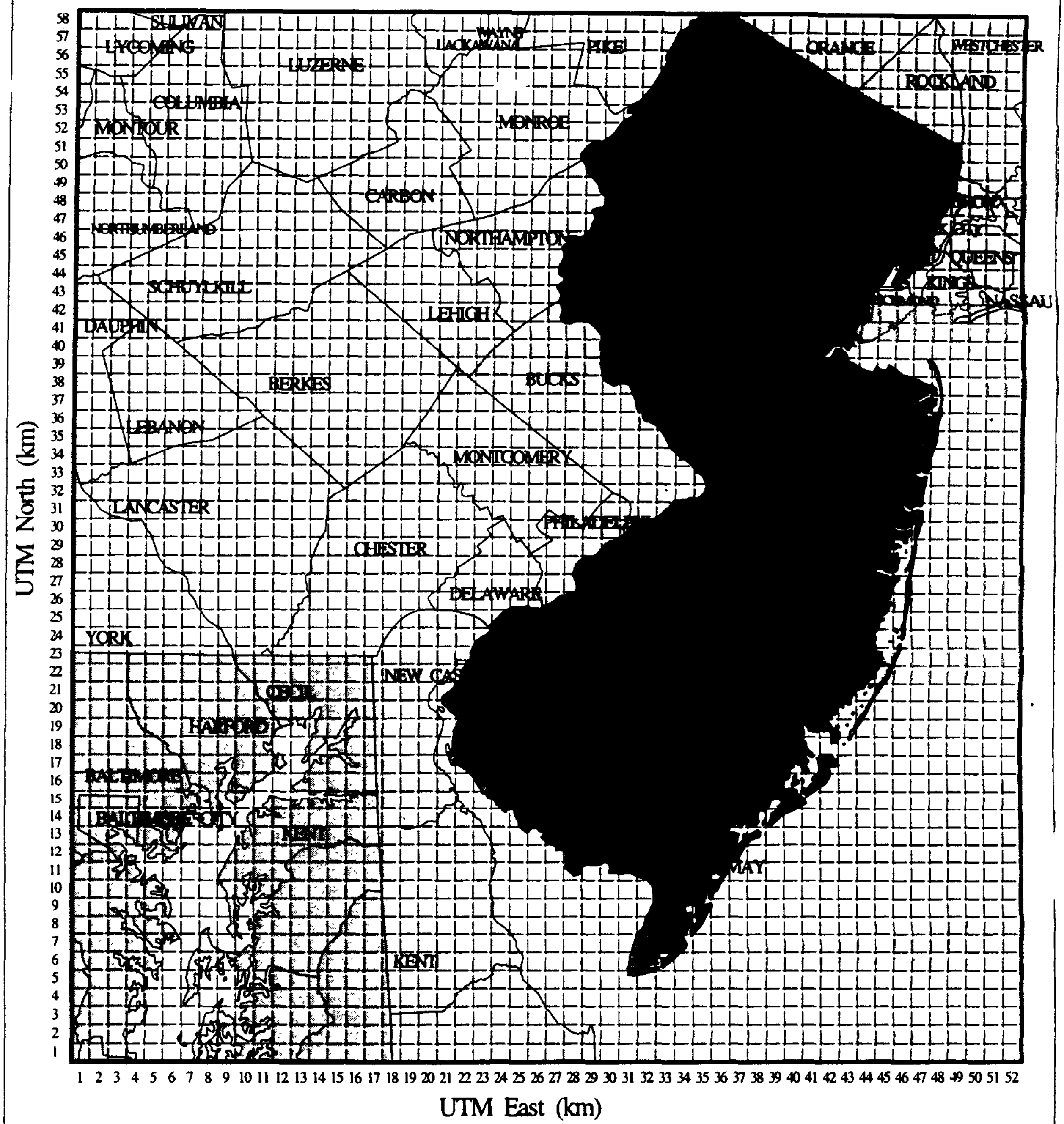
Urban Airshed Model. The Urban Airshed Model essentially creates a large number of square columns in which air pollutants are emitted, mixed, chemically reacted and then passed on to the surrounding squares. *Figure 12* (Philadelphia Modeling Domain) shows how the interstate Philadelphia area has been divided for this modeling effort, with the actual nonattainment area heavily outlined. Each square indicated by the grid is 5 kilometers wide by 5 kilometers long. The entire area is called the modeling domain. The size of the entire modeling domain is determined in part by the geographic area necessary to model the full extent of the Philadelphia ozone plume.

FIGURE 12.

Philadelphia/New Jersey Modeling Domain County Locations

UTM ZONE 18

(SW – 350,4285 km, NE – 610,4575 km)



The model incorporates altitude as well to accurately predict the chemical reactions in the atmosphere. The height of the column varies depending on daily meteorological conditions. The model calculates where, due to wind flow, mixing takes place and how chemical reactions of the pollutants occur in the atmosphere. Schematically, each column is divided vertically into five layers, with the top layer always above the mixing height. Greater detail is available in EPA's UAM IV guideline documents.

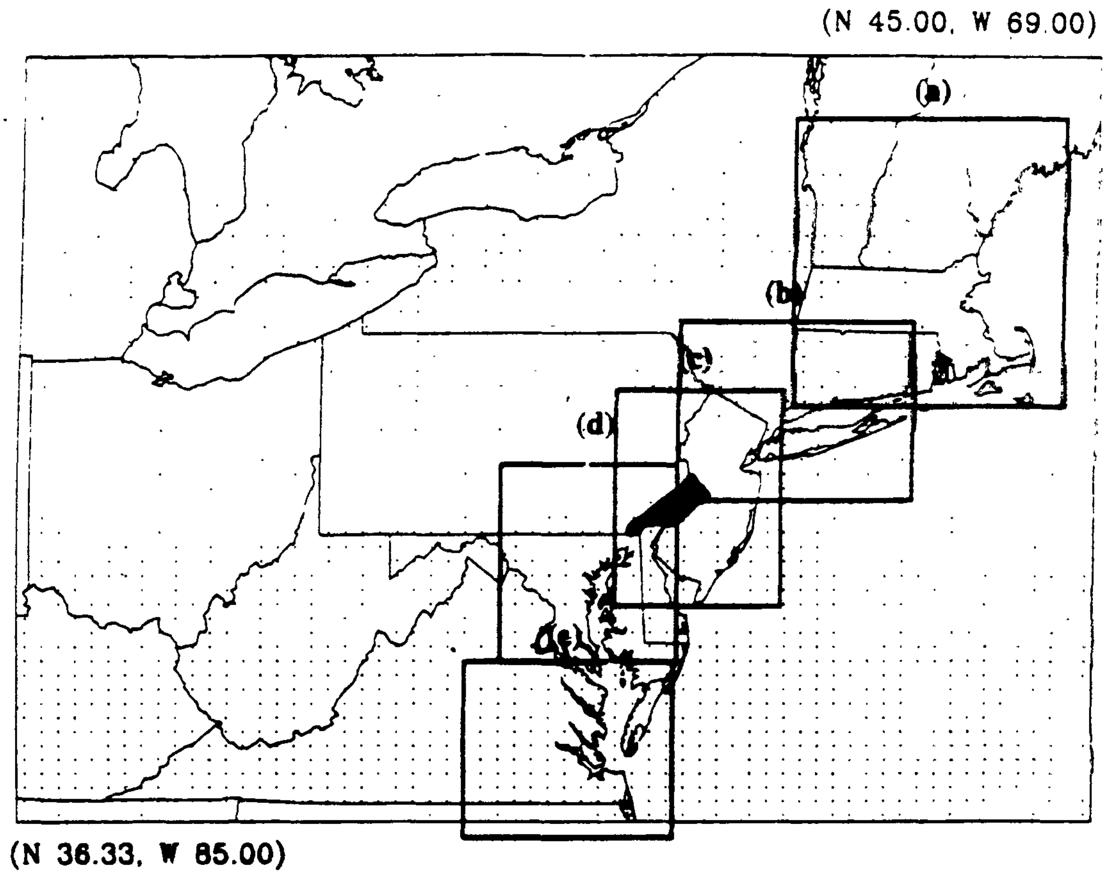
Several types of input are necessary to use the model:

- Emissions and their location are supplied by the individual states in their emission inventories.
- Meteorological conditions such as wind speed, wind direction, cloud cover, solar radiation and temperature are supplied from a variety of sources, primarily National Weather Service stations.
- Boundary conditions must be provided for each separate hour and boundary grid that is modeled. Boundary conditions are expressed as a concentration of ozone and ozone precursors on the edges of the modeling domain. This is particularly important in the Northeast where quite often, the air coming into the domain during the modeled episodes will already violate air quality standards. The expected future amounts of pollution on the boundaries must be established in order to predict pollution levels in the attainment year, 2005. Traditionally, the accepted method for obtaining this data is from EPA's Regional Oxidant Model 2.2 (ROM). EPA has run the regional model for the entire eastern United States for a series of historical episodes. This data is obtained from EPA and used for boundary conditions throughout the modeling episode. (UAM V has also been run by the Ozone Transport Assessment Group (OTAG) to predict future year concentrations for a variety of scenarios. EPA would accept OTAG UAM data for use as future year boundary conditions if a state elected to test one or more of the OTAG scenarios.)

Regional Modeling. *Figure 13* shows the Northeast portion of the area where the ROM model and the UAM V model have been run. The dots on the figure define the grid for these regional models. The figure also shows the UAM modeling domains for the five East Coast areas where UAM attainment modeling is ongoing.

As discussed in the section on UAM modeling above, the size of each domain was established to encompass an entire urban ozone plume. The interlocking domains, with the Philadelphia domain at its heart, indicate graphically the complex and interdependent nature of regional ozone problems and solutions.

Figure 13 UAM DOMAINS NESTED WITHIN GRIDDED ROMNET REGION



(a): New England UAM Airshed
SW corner (120 km E, 4570 km N) Zone 19, 68x68 cells

(b): New York UAM Airshed
SW corner (480 km E, 4440 km N) Zone 18, 58x46 cells

(c): NJ-Philadelphia UAM Airshed
SW corner (400 km E, 4305 km N) Zone 18, 42x55 cells
PA portion of nonattainment area shown as solid

(d): Baltimore-Washington UAM Airshed
SW corner (250 km E, 4235 km N) Zone 18, 46x50 cells

(e): Virginia UAM Airshed
SW corner (734.876 km E, 4002.832 km N) Zone 17, 53x49 cells

5.2 Urban Nonattainment Modeling Requirements

Photochemical modeling is required to demonstrate that the interstate Philadelphia area, a severe nonattainment ozone area, will attain the federal health-related ozone air quality standard. A simple overview of the modeling process includes:

- **Testing and validating the model to demonstrate** that it is a valid tool for prediction. This is done by determining whether the model can accurately predict ozone values for historical ozone episodes (where the actual measured ozone concentrations are already known). The model is run for several different episodes and refined until it can make these predictions.

- **Predicting future ozone levels** based on expected changes in emissions within the domain and ozone and ozone precursor concentrations along the domain boundary. These simulations are run for the same meteorological episodes as the validation run.

Re-running the model if necessary until attainment is reached. (Attainment is reached when ozone concentrations are 124 ppb or below in every grid cell.) If the decreases in emission already accounted for above do <u>not</u> result in the attainment of the ozone standard, the model is re-run with additional emission reductions until the model predicts the standard will be attained. States must adopt and enforce control measures which achieve the additional emission reductions that the model indicates are needed.

5.3 The Philadelphia Area UAM Study

The following section describes the steps that have been followed for the conduct of the Philadelphia nonattainment area UAM modeling study and describes the progress made to date.

5.3.1 Organizational Structure

As discussed, the Philadelphia Ozone Nonattainment Area involves four states. The organizations that are sponsoring the modeling study are:

- Pennsylvania Department of Environmental Protection
- Philadelphia Department of Public Health—Environmental Protection Division
- Delaware Department of Natural Resources and Environmental Control
- Maryland Department of the Environment
- New Jersey Department of Environmental Protection (NJDEP)
- EPA Office of Air Quality Planning and Standards
- EPA Region II (New York)
- EPA Region III (Philadelphia)

In addition to the above listed agencies, the following organizations are also contributing to the modeling effort (a) by providing emission and aerometric data and recommending and evaluating control strategies, (b) by comparing and discussing concurrent modeling efforts in the Northeastern US, and (c) by providing additional technical resources:

- New York State Department of Environmental Conservation
- Environmental and Occupational Health Sciences Institute (EOHSI)
- Northeast States Coordinated Air Use Management/Mid-Atlantic Regional Air Management Association
- Ozone Transport Commission
- Delaware Valley Regional Planning Commission

Computational implementation and scientific analysis of the modeling project was performed by the Air Quality Modeling Group of the Ozone Research Center at EOSHI.

The need to coordinate activities involving policy and technical decisions at nine federal and state agencies required a flexible management structure. The modeling project is administered by a Policy Oversight Committee and a Technical Coordination and Strategy Development Committee which work closely with three Technical Working Groups. Input and evaluation of databases for the photochemical airshed simulations are developed by the Emissions Technical Working Group and the Aerometric Data Technical Working Group.

Each Committee and Technical Working Group is chaired by a coordinator who is responsible for establishing regular interaction among committee/group members and for following and reporting the progress of tasks undertaken by the committee/group. A representative from each sponsoring organization/agency participates in each committee or group. The responsibilities of each participant, and therefore of the corresponding agency, are specified by the respective committee/group.

Members of the Technical Coordination and Strategy Development Committee directly report to and interact with the corresponding members in the Policy Oversight Committee from their agency/organization. Furthermore, since the Technical Coordination and Strategy Development Committee has the lead in specifying modeling procedures and in identifying data needs, its members are responsible for coordinating/tracking Technical Working Group activities locally, i.e. within their agency/organization.

The organizational structure and the responsibilities of these groups are outlined in the protocol described in Section 5.3.2.

5.3.2 Technical Protocol Establishment

Because of the complexities and potential impact on the regulated community, it was critical early on to establish a detailed technical protocol for the modeling study. The adopted modeling protocol for the Philadelphia nonattainment area is titled "Protocol for Regulatory Photochemical Air Quality Modeling of the Metropolitan Philadelphia - Southern Central New Jersey Area." This document is included in Appendix V, and is available on request. The Protocol details and formalizes procedures for conducting the modeling study including:

- Stating the background, objectives, tentative schedule and organizational structure of the study,
- Developing the necessary input data bases,
- Conducting quality assurance and diagnostic model analyses,
- Conducting model performance evaluations and interpreting modeling results, and
- Describing procedures for using the model to demonstrate whether proposed strategies are sufficient to attain the ozone National Ambient Air Quality Standard (NAAQS).

The modeling protocol may be used as a general guide to how the modeling was conducted; however, subsequent changes in EPA guidance and the formation of OTAG have resulted in changes to episode selection, modeling tools and the databases used in the final demonstration.

5.3.3 Identification Of Modeling Boundaries

The appropriate boundaries of the domain to be modeled and the methods used to determine initial and boundary conditions for air quality and meteorology information were determined. The boundaries of the domain were determined as a compromise between the computational demands for enlargement of the domain and an acceptable level of error. Factors which were considered to optimize the boundary selection included a) the degree of correlation among ozone monitoring stations as a function of distance, b) the simulation of forward and backward air-mass trajectories from selected locations (source and receptors) in the domain, and c) the performance of simulations over domains of decreasing size to determine the importance of domain size effects.

5.3.4 Selection Of Base-Case Historical Ozone Episodes

Specific historical episodes needed to be selected during the period from 1987 to the present which are representative of the different meteorological regimes conducive to ozone formation in the modeling domain. While theoretically, modeling simulations should be performed for every ozone episode for an entire three-year period, such an option is not viable due to limitations in data, resources and time. Therefore, the approach taken was to simulate a limited number of high ozone days in accordance with EPA guidance. Episodes selected corresponded to high ozone observations but not always the highest observations.

After following the procedure outlined in Appendix V, the following episodes were selected for evaluation:

Episode Modeling Dates	**Meteorological Regime**
July 5-11, 1988	Prevailing S/SW winds
June 14-15, 1987	High pressure North/West of domains
July 16-20, 1991	Prevailing S/SW winds

Current efforts are focused on whether to use the more recent 1995 episodes in place of the older 1987 and 1988 episodes.

5.3.5 Emission And Meteorological Information

Alternative methods were identified for managing and calculating detailed, episode-specific emission and meteorological information. An evaluation of "pre-processor" models and methods for managing data was completed to select the most efficient method of inputting and managing databases for the model.

The modeling study requires acquisition and pre-processing (quality assurance, adjustment to day- and hour-specific temperature and activity, allocation to the appropriate grid cell, etc.) of air quality, meteorological and emissions data to develop the necessary information for each episode to be used in the attainment demonstration model simulations. All of the air quality and meteorological data for all episodes have been collected and processed for use in the modeling study. Emissions data for the 1990 baseline and adjustment of that data as required to simulate daily emissions during the historical episodes have been collected from state and local air agencies.

5.3.6 Evaluation of Modeling Subsystems

Each of the various databases are run in the model. To assure that the pre-processors, and other modeling systems, are functioning properly and are producing reasonable results, the output of each database was reviewed in detail. This generally includes the following functions which have been completed:

- Application and component evaluation of major preprocessors (e.g. windfield generators, emission models, etc.) for each selected episode, using available field data.
- Application and evaluation of the complete modeling system with inputs prepared using meteorological and emission pre-processors for each selected episode.

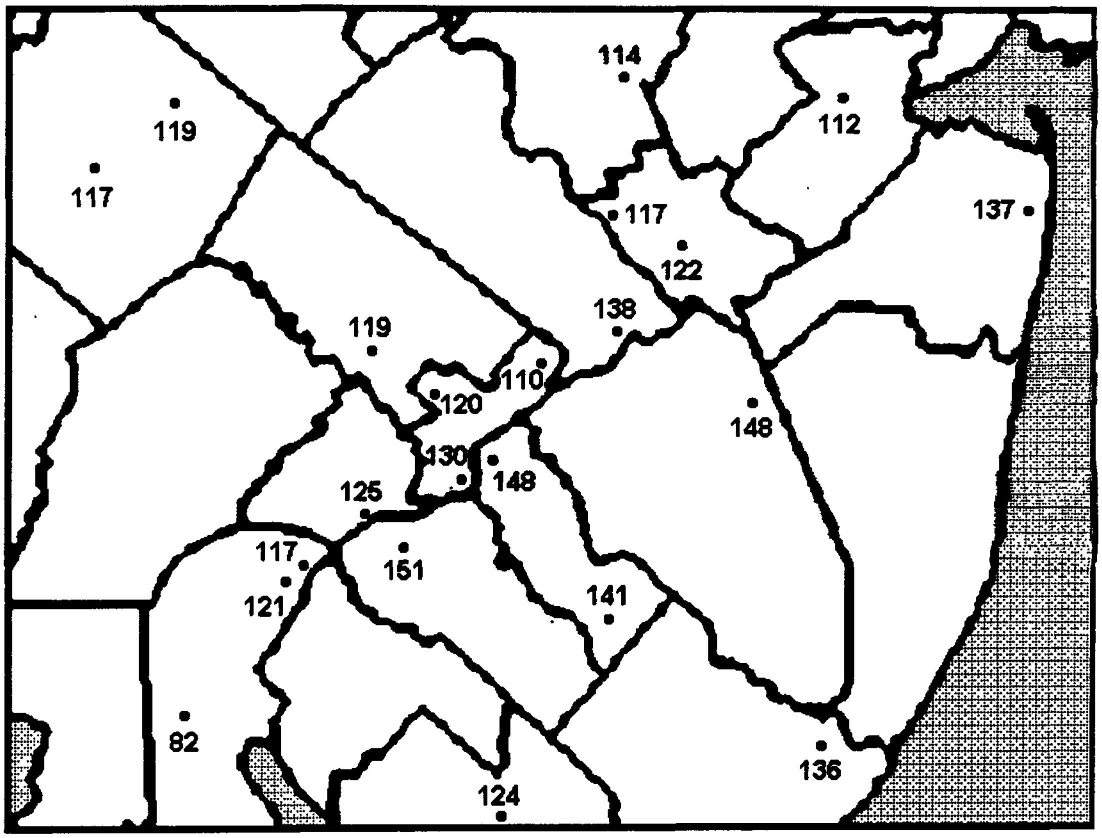
- Implementation of diagnostic analyses on each meteorological episode simulation. The principal purpose of diagnostic analyses is to ensure that the model properly characterizes physical and chemical phenomena (e.g., wind fields, spatial and temporal emission patterns) instrumental in leading to observed ozone concentrations. The objective is to improve model performance, i.e., to achieve better spatial and temporal agreement with observed data. Diagnostic model simulations also uncover potential model input data gaps.
- Refinement and correction of inputs and input estimation methods, guided by the diagnostic analyses discussed above, followed by the "base case" application of the photochemical modeling system for each selected meteorological episode.

5.3.7 Analysis Of Modeling Results

The model must be analyzed using a series of graphical and numerical performance measures to determine overall model performance in replicating observed ozone concentrations and patterns including ozone precursors. This analysis has been completed and results show adequate performance. A detailed discussion is included in Appendix V.

While a number of measures are used to assess the accuracy of peak estimates including bias, error and variance, the simplest method is to compare measured data to predicted concentrations at the same location. *Figure 14* shows the one-hour daily maximum ozone values **measured** across the Philadelphia area for July 20, 1991 as an example. *Figure 15* shows the one-hour daily maximum ozone values **predicted** by the model throughout the modeling domain. With winds from the west on this last day of a three-day episode, measured and predicted maximum values occur in eastern central New Jersey downwind of Philadelphia, as expected.

Figure 14: One-Hour Daily Measured Maximums - 7/20/91



Max Ozone Concentrations July 20, 1991

Figure 15.

Philadelphia/New Jersey UAM Domain

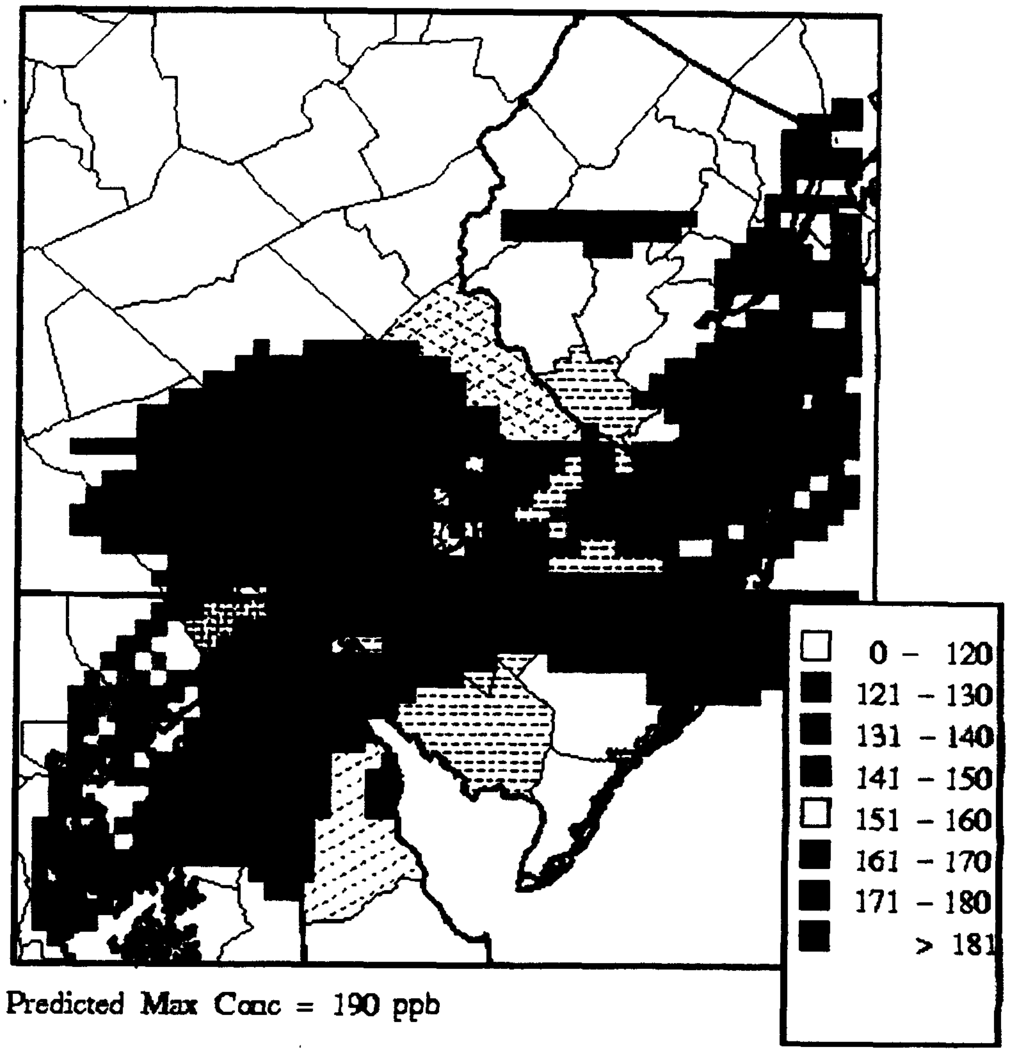
(Counties in Philadelphia CMSA shown hatched)

Daily Maximum Predicted Ozone Concentrations (ppb)

July 20, 1991 (Base Case)

UTM ZONE 18

(SW: 350 E, 4285 N, NE: 610 E, 4575 N)



Predicted Max Conc = 190 ppb

The model does an adequate job representing the distribution of ozone levels in the area. The model does tend to overpredict concentrations in the central New Jersey area. Unfortunately, no measured ozone data is available for the highest predicted area which is just east of central New Jersey (Ocean County) where predicted concentrations are at the 180 - 190 ppb level. Areas just upwind did measure 148 ppb where the model is predicting 160 - 170 ppb. Typically, one does not expect the monitoring stations to pick up the peak ozone values in a given area. Agencies cannot afford to operate dense monitoring networks that would be necessary to measure ozone values in all grids. The model therefore may, or may not, overpredict the actual peak values. However, the extent that the peak predicted values exceed the measured values, particularly without regard to location, indicates the model is probably overpredicting peak values while adequately representing the general distribution of ozone. For example, the peak measured concentration is 148 ppb while the peak predicted concentration is 190 ppb.

One other area of concern on this day is the model's modest underprediction of measured values along the eastern side of the Delaware River in New Jersey. In this area, measured concentration ranges are 148 and 151 ppb, while the model is predicting values of 130 to 140 ppb. Nearby areas, however, show predicted values of 140 to 150 ppb. In spite of these concerns, this type of model performance is considered adequate for planning purposes and is typical of most modeling results.

Because of the uncertainty associated with using a model to replicate peak ozone values on any given episode day, two additional measures were developed to better describe the persistence and severity of modeled ozone levels. **Persistence** measures the number of cells (or grids) in the modeling domain having ozone concentrations of more than 120 ppb, summed for 24 hours. This tends to measure the extent of the ozone levels above the standard over space and time.

The second measure is **severity**. This is the total concentration of cells having ozone levels over 120 ppb, summed for 24 hours. Thus, it reflects the degree to which the ozone standard is exceeded for a given day. The values of persistence and severity can be used to compare episode days to each other or to compare one episode to another. The following shows these values for the two primary episodes. The greater value of these metrics, however, is in comparing the success of various emission control strategies for achieving attainment. This will be discussed in the next section.

	Predicted O_3 Maximum (ppb)	Persistence	Severity
July 7, 1988	185	4,175	553
July 8, 1988	213	8,239	1,126
July 19, 1991	156	630	82
July 20, 1991	190	4,958	660

5.3.8 Estimate Emissions and Air Quality For Projected Attainment Year

For each meteorological episode selected, emissions for the projected attainment year, (2005) must be estimated. Model simulations must be performed for each episode to project ozone concentrations after implementation of emission control measures. The results are reviewed to determine whether the ozone standard will be met in 2005.

Two projected emission inventories or control strategies were developed. These were not developed for the 1987 episode due to the lack of a regional (ROM) simulation (see Appendix V, reference 2). Control Strategy One represents implementation of the Clean Air Act requirements and includes most programs presented in the rate of progress plan. Because of the long lead times in completing modeling efforts, some of the more recent controls or control program changes are not included in the modeling inventories. Control Strategy Two adds national controls for a low emission vehicle program and stringent NOx controls on utility boilers. Specific strategies are presented in Appendix V.

Changes in peak concentrations, persistence and severity as shown below:

July 8, 1988 Meteorology

	Peak Concentration	Persistence	Severity
Base Case	213	8,239	1,126
Strategy 1	178	2,721	366
Strategy 2	177	1,568	207

July 20, 1991 Meteorology

	Peak Concentration	Persistence	Severity
Base Case	190	4,958	660
Strategy 1	161	1,473	192
Strategy 2	152	766	99

These strategies predict reductions of 29-38 ppb in peak ozone concentrations showing substantial improvement. For the 1991 episode, this would bring predicted concentrations at monitoring locations below the one-hour standard, where the peak measured level was 151 ppb. This would not be true for the 1988 episode, where measured levels were as high as 212 ppb.

In addition, significant reductions are achieved in the persistence and severity levels for 2005. Persistence was reduced by 67 - 70% for Strategy One and 81 - 85% for Strategy Two. Severity was similarly reduced by 67 - 71% for Strategy One and 82 - 85% for Strategy Two. These reductions in the level and extent of ozone concentrations fit well with the reductions in measured concentrations presented in Chapter 4.

6. Interstate Transport

6.1 Background

Attainment of the health-related one-hour ozone air quality standard in the Philadelphia Interstate Nonattainment Area has been impossible due to the transport of ozone and ozone precursors into the area. Emission reductions from previous air pollution control efforts have significantly improved air quality in the Pennsylvania portion of the Philadelphia Metropolitan Area, lowering ground-level ozone in the area to concentrations approaching the one-hour health-related standard.

However, the area has still experienced ozone air pollution levels in excess of the one-hour standard during summer episode conditions. In addition, significant exceedances continue to occur both upwind and downwind of the area. ***Figures 16a-d*** show the regional ozone concentrations in ppb of ozone for days during 1997 where levels in the five-county Philadelphia area were greater than the one-hour standard. These figures demonstrate graphically the overwhelming transport of ozone into the urbanized Philadelphia area, since concentrations above the standard are found at upwind monitors.

Pennsylvania and EPA recognize, and technical analysis demonstrates, that reductions in the transport of ozone and NOx are necessary to achieve the ozone standard not only in the Philadelphia area but also in the entire Eastern United States. Measured air quality and studies commissioned by the Southeast Pennsylvania Ozone Stakeholders and others show that Southeastern Pennsylvania is substantially affected by transported ozone and ozone precursors from other states. Reductions in transported ozone and NOx from states in the midwest and south are necessary if the one-hour ozone standard is to be achieved in the Philadelphia Interstate Nonattainment Area.

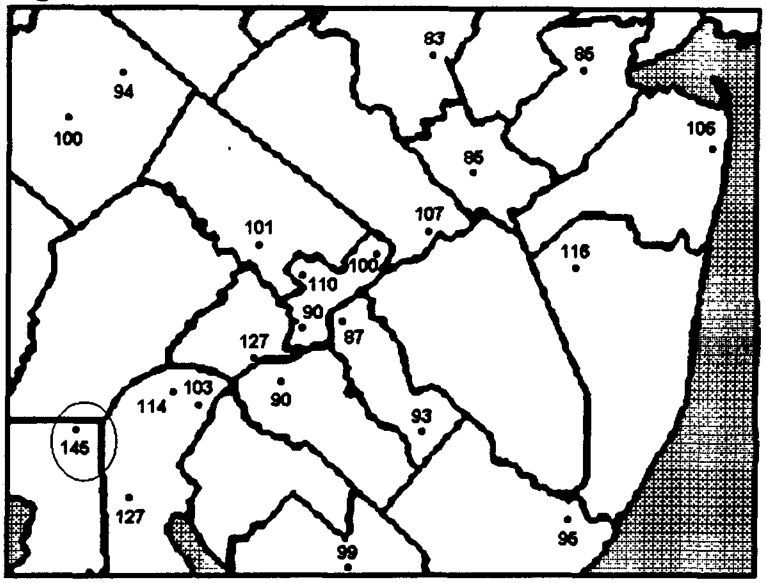
In a manner similar to Governor Ridge's creation of the Southeastern Pennsylvania Ozone Stakeholders working group discussed previously in Chapter 3, EPA and the Environmental Council of States created the Ozone Transport Assessment Group (OTAG). OTAG was formed to assist states in the eastern half of the country in attaining the federal clean air standards for ozone and to develop regional strategies to address the regional ozone problem.

This national workgroup was composed of representatives from the 37 easternmost states, the District of Columbia, and other interested stakeholders from industry and environmental groups. The workgroup's goal was "to identify and recommend a strategy to reduce transported ozone and its precursors, which, in combination with other measures, will enable attainment and maintenance of the ozone standard in the OTAG region."

The work done by OTAG is the most complete technical analysis of ozone transport done to date. One of the primary conclusions reached by OTAG was that "regional NOx reductions are effective in producing ozone benefits; the more NOx reduced, the greater the benefit." As a result, OTAG recommended ranges of utility and non-utility NOx control levels for much of the OTAG region. Further information is available on the OTAG web site (http://www.epa.gov/ttn/OTAG).

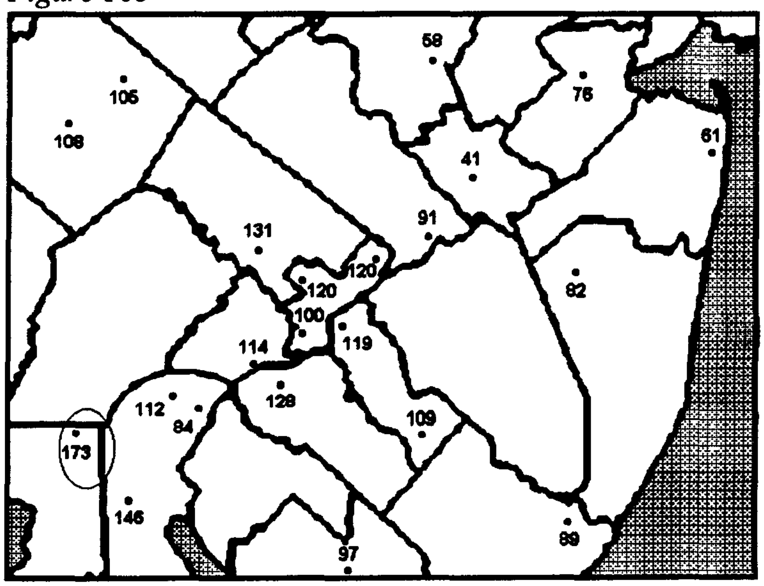
The Pennsylvania Stakeholders made their recommendations for additional local controls in anticipation that other regions, particularly upwind areas, would implement similar levels of control to improve southeastern Pennsylvania's air quality. Since the Stakeholders Final Report in January 1997, two important follow-up actions have occurred to deal with transported ozone and ozone precursors: the filing of a petition under Section 126 of the Clean Air Act by several states and a call for State Implementation Plan revisions.

Figure 16a



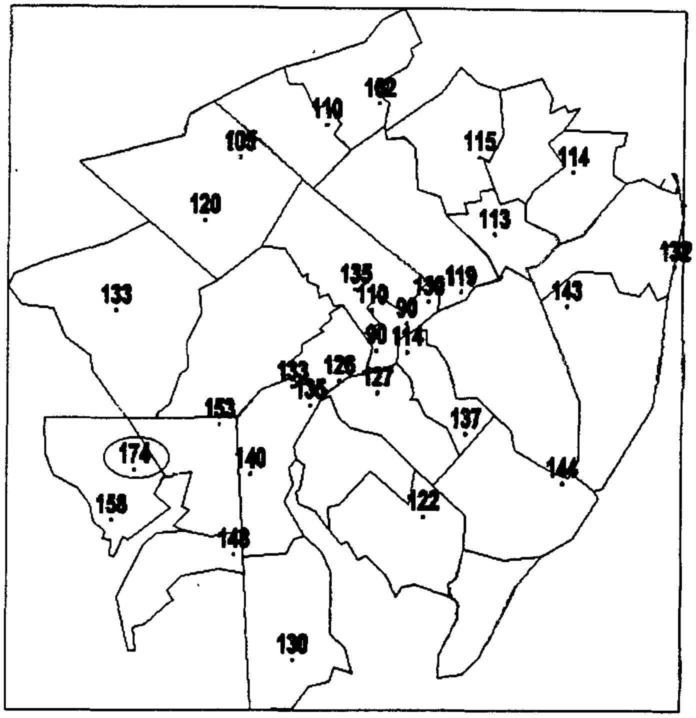
Maximum Ozone - June 20, 1997

Figure 16b



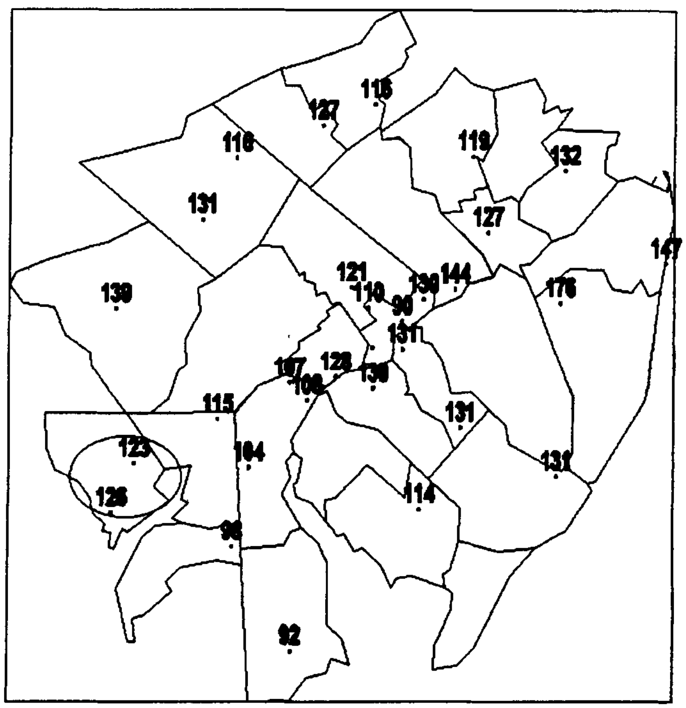
Maximum Ozone - June 24, 1997

Figure 16c



Maximum Ozone - July 14, 1997

Figure 16d



Maximum Ozone - July 15, 1997

6.2 Pennsylvania Sec. 126 Petition

Governor Ridge filed a petition on August 14, 1997 with EPA asking it to take action to reduce air pollution coming into the Commonwealth from other states. Section 126 of the federal Clean Air Act gives states the ability to require EPA to address the issue of transport of pollution. Pennsylvania is using Section 126 to petition EPA in an effort to reduce emissions from a category of air pollution sources – large fossil-fuel fired combustion units and electric generating facilities – in most of the OTAG region.

The petition requests 55% reduction from 1990 baseline levels at these sources by 1999, with an assessment to follow to determine if additional reductions are necessary. Pennsylvania has already promulgated a regulation requiring a 55-65 % reduction from Pennsylvania sources. The petition requests that EPA establish specific emission limitations and reductions on the affected units in the 19 named states, as well as a schedule for compliance, if necessary. Seven additional northeastern states also filed similar Petitions for Abatement of Excess Emissions with EPA seeking similar NOx reductions.

The need for upwind emission reductions is documented in the Pennsylvania Section 126 petition which is included in Appendix V. This petition supports the OTAG process by requesting EPA to ensure reduction of ozone and ozone precursor transport through specific NOx reductions from large fossil fuel-fired combustion units within much the OTAG area.

Additional information in the petition reviews expected air quality improvements, aircraft measurements at the PA border, back trajectory analysis of the path of high ozone air masses arriving in Pennsylvania on exceedance days and monitored ozone data for Pennsylvania.

EPA and the states that filed the petitions, including Pennsylvania, entered into a scheduling agreement for EPA action. In general, that agreement provides:

"a) By April 30, 1998, EPA agrees to take preliminary action on the petitions (advanced notice of proposed rulemaking),

b) By September 30, 1998, EPA will publish a notice of proposed rulemaking and will hold a public hearing within 30 days after the notice is published,

c) By April 30, 1999, EPA will take final action on the petitions,

d) EPA must propose to approve a state or federal plan by November 30, 1999 and give final approval by May 1, 2000. Otherwise the requirements of an approved Sec. 126 petition will be in effect."

Further documentation of transport of air pollution is presented in the petition, its appendices, similar petitions by other states and information available from the OTAG process and the OTAG web site previously referenced.

6.3 EPA Sec. 110 SIP Call

On November 3, 1997, EPA proposed a "Finding of Significant Contribution and Rulemaking for Certain States in the OTAG Region for Purposes of Reducing Regional Transport of Ozone." This action, under Section 110 of the federal Clean Air Act, proposes SIP calls for 22 states and the District of Columbia.

During the OTAG process, EPA committed to address the transport issue for states where transport from them interfered with ozone attainment under Sec. 110 of the federal CAAA. In this proposed finding, EPA takes the first step toward fulfilling this commitment. The proposed rulemaking includes both a determination that these reductions are necessary for Pennsylvania to achieve the one-hour standard and a SIP call to 22 states to address the transport problem. The proposal sets forth emissions budgets for 22 of the 37 OTAG states. EPA finds that these 22 states "significantly contribute to nonattainment in, or interfere with maintenance by, a downwind state."

These SIP calls would require affected states to reduce NOx emissions to levels specified in the proposal. Individual states could choose how to achieve those reductions. The proposal calls for final requirements to be set in September 1998 and for states to submit required regulations and plans by September 1999. The reductions are to be achieved by September 2002.

EPA has indicated that these reductions are necessary for meeting the one-hour health standard for ozone and are a central component for meeting EPA's new ozone standard that was made final in July 1997. The proposed strategy was developed by EPA to implement the cooperatively-developed recommendations of the 37 OTAG states.

States, including Pennsylvania, would be required to adopt and submit, within 12 months after publication of final rulemaking, SIPs containing control measures that will mitigate the ozone transport problem by meeting these assigned statewide emissions budget.

The state by state NOx percentage reduction targets included in EPA's proposed SIP call (62 FR 60318) are as follows:

STATE	% Reduction	STATE	% Reduction
Alabama	36	New Jersey	25
Connecticut	21	New York	19
Delaware	28	North Carolina	34
District of Columbia	9	Ohio	43
Georgia	35	Pennsylvania	32
Illinois	38	Rhode Island	19
Indiana	42	South Carolina	31
Kentucky	40	Tennessee	35
Maryland	36	Virginia	21
Massachusetts	32	West Virginia	44
Michigan	32	Wisconsin	35
Missouri	43		

EPA believes that OTAG strategy run 5, which is shown in *Figure 17* (with July 20, 1991 meteorology), is closest to the emissions reductions and air quality improvement expected from the EPA proposed SIP call. This strategy would require significant NOx and VOC reductions from a variety of sources as outlined in more detail in EPA's proposal. Expected reductions throughout the Philadelphia areas are from 12 to 20 ppb. Given the current design value of 138 ppb, the result should leave a design value from 118 to 126 compared to the standard of 124 ppb. Thus, it is not unreasonable to predict that appropriate reduction of transport, when combined with ongoing programs, will lead to attainment of the one-hour standard.

Diff in O3 Peak: Run 5 –Bas 1C

Run 5 = Lev 3 Util NOx, Lev 1 non-Util pt. NOx, Lev 1 Area, Lev 0 Motor V
OTAG –– Midwest Modeling Center

Figure 17
Ozone Reduction from OTAG Run 5

Appendix I:
Ozone Attainment Demonstration Process

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

RECEIVED
Air Program Branch

MAR 2 - 1995

MAR 6 1995

EPA, REGION III
OFFICE OF
AIR AND RADIATION

MEMORANDUM

SUBJECT: Ozone Attainment Demonstrations

FROM: Mary D. Nichols Mary Nichols
Assistant Administrator for Air and Radiation

TO: Regional Administrator, Regions I-X

The purpose of this memorandum is to provide guidance on an alternative approach to provide States flexibility in their planning efforts for ozone nonattainment areas classified as serious and above. The basic principles of this approach are: 1) meeting the attainment dates in the Clean Air Act while maintaining progress, 2) ensuring enforceability of commitments to adopt additional measures needed to reach attainment, and 3) promoting market-based alternatives. The EPA will work with States to encourage the development of market-based trading programs to provide flexibility in meeting the requirements of these control measures. This guidance applies to areas significantly affected by ozone transport. In consultation with your States, you should determine whether it is appropriate to apply it to other areas as well.

Background

The 1990 Clean Air Act Amendments set forth many new requirements intended to address widespread nonattainment of the NAAQS for ozone. Although a great deal of work has been done and significant progress has been made, many States have been unable to complete these State implementation plan (SIP) requirements within the schedules prescribed in the Act due to circumstances beyond their control. This is a particularly difficult problem for areas affected by transport of ozone and ozone precursors. These areas must develop complex regulatory plans, based on photochemical grid models that in many cases must take into account upwind and downwind flow of ozone and precursors. The models, in turn, must be based on detailed emission inventories and other inputs, the development of which has been unavoidably delayed due to unforeseen difficulties in gathering the necessary data. Similarly, in many instances, the large amount of reductions likely to be needed to demonstrate attainment, and the consequent difficulties in developing control measures to achieve those reductions, has resulted in unavoidable delays in rule development by the States.

needed from upwind areas for the area to meet the NAAQS. The commitment should also specify a schedule for completing adoption of additional rules. An enforceable commitment is one that has been adopted into the SIP by the State and is submitted to EPA as a SIP revision. The EPA will work with States regarding the specific commitments that are needed.

States should submit, by May 1995, a letter committing to follow the approach described in this guidance, as well as a general explanation of efforts to date to complete both the attainment modeling (and the emission inventory and other inputs to the model) and the regulations necessary to achieve reductions. The letter should include a schedule for the adoption of enforceable rules needed to implement the required phase I control measures.

In order to provide lead time for phased implementation of those measures not later than May 1999, any measures not already scheduled for earlier adoption should be adopted no later than the end of 1995. If administrative scheduling, such as legislative sessions or State review procedures renders it impossible for a control agency to complete the regulatory process for certain rules by the end of 1995, the State may propose a schedule providing for the adoption of such rules during 1996. Again, the important point is that the State must adopt enforceable measures by a date that ensures adequate lead time to enable full implementation no later than May 1999. The Regions should track States' progress toward completion of the adoption process.

Phase II

The second phase of this approach begins with a 2-year process, ending at the close of 1996, to assess regional control strategies and refine local control strategies, using improvements in the modeling process (e.g., more refined emission inventories) to perform further control strategy evaluations that take into consideration potential regional control strategies. This will also give the States and EPA the opportunity to determine appropriate regional strategies to resolve transport issues. The goal of phase II is for EPA and the affected States to reach consensus on the additional regional, local and national emission reductions that are needed for the remaining rate-of-progress requirements and attainment. In the event that agreement is not reached, EPA intends, by the end of 1997, to use its authority under the Act (e.g., under sections 126 and/or 110) to work with all affected States to ensure that the required reductions are achieved.

Based on the results of the 2-year assessment, States will be expected to submit by mid-1997 the modeling and attainment plan to show attainment through local and regional controls. The

Appendix II: Acronyms

Appendix II: Acronyms

BEA	U.S. Dept. of Commerce, Bureau of Economic Analysis
CAAA	Clean Air Act Amendments of 1990
CTG	Control Techniques Guidance
DEP	PA Department of Environmental Protection
DVRPC	Delaware Valley Regional Planning Commission
EQB	Environmental Quality Board
EPA	U.S. Environmental Protection Agency
FMVCP	Federal Motor Vehicle Control Program
MACT	Maximum Available Control Technology
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NEDS	National Emissions Data System
NLEV	National Low Emission Vehicle
NOx	Oxides of Nitrogen
OAQPS	Office of Air Quality Planning and Standards
OTAG	Ozone Transport Assessment Group
PEDS	Pennsylvania Emissions Data System
PennDOT	Pennsylvania Department of Transportation
PPAQ	Post Processor for Air Quality
ppb	parts per billion
ppm	parts per million
RACT	Reasonably Available Control Technology
ROP	Rate of Progress
RVP	Reid Vapor Pressure
SIC	Standard Industrial Classification
SIP	State Implementation Plan
TCM	Transportation Control Measure
TDM	Traffic Demand Model
TPD	Tons Per Day
TPSD	Tons Per Summer Day
UAM	Urban Airshed Model
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound

Appendix III:
Rate of Progress Plan Technical Methodology

Phase II - Appendix III

A. *Calculation of Target Levels*

In order to determine which control strategies - in addition to the mandated federal programs - are necessary to achieve the required VOC or VOC-equivalent emission reductions by 2005, DEP must calculate the target level of emissions for the attainment year. This section explains the procedures used for calculating that level. This considers growth in emissions from the 1990 baseline and adjustment for each milestone year between 1990 and 2005. The milestone years considered are 1996, 1999 and 2002. Emissions and emission reductions for the 2005 plan are calculated on a typical weekday basis for the peak three-month ozone period of June, July, and August. The documentation accounts for the 15% reduction in VOC between 1990 and 1996 and the three percent per year emission reduction levels over the period between 1996 and 2005.

In this section, the calculation methodology is presented and explained, followed by the actual calculation of the target level of emissions for 2005 and the target levels of the respective milestone years. The 1996 target methodology is detailed in a previous submission.

1. Target Level - Calculation Methodology

The target level of emissions represents the maximum amount of emissions that the nonattainment area can emit for the target year and still comply with the rate-of-progress plan requirements. This section outlines the general approach to calculating the target level of emissions and proceeds through a detailed description of the calculation. The following generalized equations describe the calculation of the target level for an arbitrary year:

TARGET LEVEL = (previous milestone's target level) - (reductions required to meet the rate-of-progress requirement) - (fleet turnover correction term).

The equation can also be expressed in terms of variables: requirement

$$TLx = TLy - BGr - FTx$$

Where:

x = Current Milestone
y = Previous Milestone
TL = Target Level
BG = Emissions Reduction Requirement
FT = Fleet Turnover Correction

The target level for each milestone year (TLx) is calculated by subtracting the three percent per year rate-of-progress emission reduction (BGr) and the fleet turnover correction term (FTx) from the previous milestone year (TLy). The specific steps needed to calculate the target are discussed below. There are six major steps in calculating the 2005 target level of emissions. The first four steps are needed to calculate the three-percent per year rate-of-progress emission reductions. Steps 1 and 2, developing the 1990 base year inventory and the 1990 rate-of-progress base year inventory, were previously submitted by DEP in the 15% ROP plan for the Pennsylvania counties in the Philadelphia Interstate Ozone Nonattainment Area. The inventories contained in the 15% ROP plan were prepared in accordance with the EPA document entitled "Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15 Percent Rate-of-Progress Plans."

Step 1: Develop the 1990 base year inventory.
The total 1990 base year emissions from the five emission source types (point, area, highway vehicle, nonroad and biogenic) were compiled. There have been no changes to inventory between submittal of the 15 percent rate-of-progress plan and the rate-of-progress plan.

Step 2: Develop the 1990 rate-of-progress base year inventory.
Biogenic source emissions and other emissions from sources located outside the nonattainment area, but included in step 1, were removed from the 1990 base year inventory.

Step 3: Adjust the 1990 base year inventory to each target year.
The CAA specifies the emissions "baseline" from which each emission reduction milestone is calculated. §182 (c)(2)(B), which is applicable based on §182(d), states that the reductions must be achieved "...from the baseline emissions described in subsection (b)(1)(B)." This baseline value is called the 1990 adjusted base year inventory. §182(b)(1)(B) defines baseline emissions (for purposes of calculating each milestone VOC and NOx emission reduction) as "...the total amount of actual VOC or NOx emissions from all anthropogenic sources in the area during the calendar year of enactment...."

This section excludes from the baseline the emissions that would be eliminated by federal motor vehicle control program (FMVCP). Also excluded are regulations promulgated by January 1, 1990, and Reid vapor pressure (RVP) regulations promulgated by the time of enactment (55FR 23666, June 11, 1990), which require maximum RVP limits for gasoline to be sold in nonattainment areas during the peak ozone season.

The 1990 adjusted base year inventory must be recalculated relative to each milestone and attainment date because the emission reductions associated with the FMVCP increase each year due to fleet turnover. Thus, the 1990 adjusted base year inventory relative to each milestone year was calculated. The only adjustment that needed to be made to the inventory was to recalculate the highway vehicle emissions using MOBILE5a. This adjustment was made by calculating a separate highway vehicle emission factor for each milestone. The emission factors were then multiplied by 1990 vehicle miles traveled (VMT) to yield the highway vehicle emissions that were subtracted from the 1990 rate-of-progress base year inventory to calculate the 1990 adjusted base year inventory for the milestone.

These reductions are calculated as follows:

FMVCP/RVP Reductions Between 1990 and year x = (Actual 1990 highway vehicle emissions) - (Adjusted 1990 highway vehicle emissions)

Where:

Actual 1990 highway vehicle emissions = (1990 VMT) (1990 Baseline emission factors), and
Adjusted 1990 highway vehicle emissions = (1990 VMT) (Adjusted year x emission factors)

The 1990 baseline emission factors were calculated using MOBILE5a runs from the 1990 base year inventory. Emission factors from these runs were used with actual 1990 VMT to calculate actual 1990 emissions.

The year x adjusted emission factors were calculated using MOBILE5a runs as in the 1990 base year inventory, except that milestone year emissions were used as the evaluation year (this will change the vehicle mix to account for fleet turnover). Emission factors from these runs were used with actual 1990 VMT to calculate adjusted 1990 emissions relative to year x.

A detailed description of the procedure for calculating the 1990 adjusted base year inventory is provided in an EPA document entitled "Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15 Percent Rate-of-Progress Plans." The adjusted base year inventory was calculated the same way for each milestone year.

Step 4: Calculate 3 percent per year reductions.
In general, to compute the required emission reductions, the number of years between successive milestone dates should be multiplied by 0.03 This results in a 9% required reduction in each milestone year. Next, this percentage figure is multiplied by the adjusted base year inventory calculated relative to the current milestone/attainment date to yield the required emission reduction.

$$BGr = BEx \times r$$

Where:

BGr = Emission reduction requirement by milestone/attainment year (in lb/day)
BEx = 1990 adjusted base year inventory calculated relative to year x
r = Percent reduction needed to meet the rate-of-progress requirement.

Step 5: Calculate fleet turnover correction term.
In the absence of any new requirements of the CAA, there would still be some decrease in motor vehicle emission factors for many years as a result of fleet turnover; the gradual

replacement of older pre-control vehicles with newer vehicles with controls. The CAA does not allow states to take credit for these reductions for rate-of-progress purposes. During the calculation of the milestone target, these "FMVCP reductions" (along with non-creditable RVP reductions) that would occur between 1990 and the milestone were subtracted from the 1990 rate-of-progress base year inventory to calculate the 1990 adjusted base year inventory. This 1990 adjusted base year inventory was then used to calculate the required reductions and each target. Because nonattainment areas are required to meet their previous targets, the calculation of each target must be based, in part, on the prior one. In the previous step (step 4), the adjusted base year inventory was multiplied by the total percent required reduction in order to determine the reductions required in the target year. This emission reduction requirement must then be subtracted from the emission target in the previous milestone year to calculate the new milestone target. However, one additional correction term, the fleet turnover correction, is needed to properly calculate the target.

The fleet turnover correction is needed to account for the highway vehicle emission reductions that would have occurred under the pre-CAA enactment FMVCP and RVP requirements (under 55 FR 23666) between consecutive milestone years. For example, assume that a nonattainment area has met the milestone target for 1996. The further creditable reduction required to meet the 1999 rate-of-progress requirements was calculated in step 4. However, between 1996 and 1999, there will be some additional reductions in emissions due to fleet turnover of older vehicles that are not creditable. These reductions must also be subtracted from the 1996 target to determine the 1999 target. These additional, non-creditable, reductions are referred to here as the fleet turnover correction term.

The calculation of the fleet turnover correction term is simple and does not require any additional MOBILE runs beyond what has been required in previous steps of this calculation. For the general case, the fleet turnover correction term is calculated as follows:

> *Milestone Year Fleet Turnover Correction = 1990 Adjusted to Prior Milestone Year - 1990 Adjusted to the Milestone Year Inventory*

The adjusted 1990 highway vehicle emissions for each milestone was calculated earlier in step 3 as 1990 VMT times MOBILE5a emission factors for the current target year with all new Clean Air Act measures disabled and RVP set to the Phase 2 limit required in Summer 1992. The adjusted 1990 highway vehicle emissions for each year were calculated using the same methodology as used in the 15% ROP plan submission.

Step 6: Calculate target level of emissions.
To calculate the target level of emissions, the required emission reductions calculated in step 4 and the fleet turnover correction term from step 5 are subtracted from the prior target level.

Target level = (prior target level) - (reductions required to meet the rate-of-progress requirement, calculated in step 4) - (fleet turnover correction term, calculated in step 5).

This target represents the level of emissions that must be achieved in order for a the Philadelphia area to demonstrate compliance with the rate-of-progress requirement for the milestone.

2. Target Level of Emissions - Actual Calculation

Following the methodology described above, the actual target level of emissions is calculated in the manner detailed below.

Step 1: Develop 1990 base year VOC emission inventory (tons/day)
See the 15% ROP Plan
Step 2: Develop 1990 rate-of-progress base year inventory (tons/day)
See the 15% ROP Plan
Step 3: Calculate the 1990 adjusted base year inventories.
This inventory was adjusted to take into account non-creditable highway vehicle emission reductions and RACT fix-ups. This highway vehicle adjustment was made by calculating the highway vehicle emission factors for the milestone, multiplying the emission factor by 1990 VMT, and subtracting that total from the 1990 actual highway vehicle emissions to yield the FMVCP and RVP reductions between 1990 and the milestone.

Table 1 Adjusted VOC Inventory

Adjusted	1999	2002	2005
Point	152.75	152.75	152.75
Area	194.35	194.35	194.35
Nonroad	80.56	80.56	80.56
Highway Vehicle	148.45	144.64	143.08
	576.11	572.30	570.74

Step 4: Calculate 3 percent per year reductions.
The 1990 adjusted base year inventory calculated relative to the milestone year is multiplied by 0.09 to calculate the required emission reductions from 1996 to that year.

Table 2 Required VOC Reductions

	1999	2002	2005
VOC reduction	51.85	51.51	51.37

Step 5: Calculate fleet turnover correction term.
The fleet turnover correction term is the difference between the FMVCP/RVP emission reductions calculated in step 3 and the previous milestone year's FMVCP/RVP emission reductions. These numbers are based on the adjusted highway emissions listed above.

Table 3 Fleet Turnover Correction Term

	1999	2002	2005
Fleet Correction	6.42	3.81	1.56

Step 6: Calculate target level of emissions for each milestone.
To calculate the target level of emissions for the milestone, the required emission reductions calculated in step 4 and the fleet turnover correction term are subtracted from the previous milestone year's target level

Table 4 VOC Target Level Calculation

	1999	2002	2005
Previous Milestone Target	494.31	436.04	380.72
VOC reduction	-51.85	-51.51	-51.37
Fleet Correction	-6.42	-3.81	-1.56
Target	436.04	380.72	327.79

In addition, the plan must also account for growth; this will be described in the next section.

B. Growth Calculations

The required reductions listed above must be achieved from anthropogenic VOC emission levels reported in the state's 1990 Base Year Inventory after those levels have been adjusted downward to remove emission reductions achieved by the pre-1990 FMVCP and the use of 9.0 RVP gasoline. The planned reductions must also offset the expected growth in VOC emissions. As a result, the total reduction necessary from the baseline is greater than 3% per year. The following table shows the effect of uncontrolled growth on the VOC inventory. (The totals of these categories may be ± .01 due to rounding.)

Table 5 Projected Inventory Without Additional Controls

Baseline	1999	2002	2005
Point	162.50	165.82	169.13
Area	202.86	205.11	207.23
Nonroad	82.63	83.22	83.79
Highway Vehicle	176.86	180.33	186.94
Totals	624.84	634.48	647.08

1. Growth Factor Methodology

The Projected Year Inventory is developed by applying growth factors to the Base Year Inventory. Guidance from the EPA suggests four typical indicators of growth. In order of priority, these are product output, value added, earnings and employment.

Surrogate indicators of activity developed by a state, such as population, may also be acceptable methods. The Bureau of Economic Analysis (BEA) provided projections of income, employment, and population from which appropriate growth factors were derived.

The BEA provides state specific historical data for 1973, 1979, 1983, and 1988 and projection estimations for 1995, 2000, 2005, 2010, and 2040 for each indicator it considers. 1973 and 1979 were not included in the analysis because the economic changes in Pennsylvania in those years create a nonlinear growth rate. Data for 2010 and 2040 were also excluded because of a lack of confidence in the projections.

Since the BEA did not provide data for 1990, 1999 and 2002, these numbers are calculated by assuming a linear growth rate between the two closest years where data exists (i.e. 1988, 1995, 2000 and 2005). For example, 1990 values are derived using the following formula:

$$IND90 = IND88 + ((2 \div 7) \times (IND95 - IND88))$$

where:

IND?? = BEA value for the chosen category for the year ??

The data were then reviewed in comparison to the 1983, 2000, and 2005 data to verify that the assumption of linear growth was valid.

2. Point Source Emissions Growth Calculation

Growth in the point source inventory was calculated, without exception, based on growth in income. The BEA projects growth in 57 industrial groups that can, for the most part, be matched to a two-digit Standard Industrial Classification (SIC) code.

Table 6 shows the growth factors by SIC code for 2005. The same methodology is used to calculate growth factors for the milestone year uncontrolled inventories which are detailed later in this appendix.

Table 6 Point Source Growth Factors (1990 - 2005)

2-Digit SIC Code	Source Description	Growth Factor	2-Digit SIC Code	Source Description	Growth Factor
01	Agricultural Production-crops	1.136	45	Transportation By Air	1.471
02	Agricultural Production-livestock & Animal Special	1.136	46	Pipelines, Except Natural Gas	1.094
07	Agricultural Services	1.414	47	Transportation Services	1.431
08	Forestry	1.414	48	Communications	1.202
09	Fishing, Hunting And Trapping	1.414	49	Electric, Gas And Sanitary Services	1.284
10	Metal Mining	1.063	50	Wholesale Trade-durable Goods	1.207
12	Coal Mining	0.957	51	Wholesale Trade-nondurable Goods	1.207
13	Oil And Gas Extraction	0.988	52	Building Materials, Hardware, Garden Supply	1.244
14	Mining And Quarrying Of Nonmetallic Minerals	1 220	53	General Merchandise Stores	1.244
15	Building Construction-general Contractors & Bldrs	1.165	54	Food Stores	1.244
16	Heavy Construction Other Than Bldg Constr-contract	1.165	55	Automotive Dealers And Gasoline Service Stations	1.244
17	Construction-special Trade Contractors	1.165	56	Apparel And Accessory Stores	1.244
20	Food And Kindred Products	1.065	57	Home Furniture, Furnishings & Equipment Stores	1.244
21	Tobacco Products	0.705	58	Eating And Drinking Places	1.244
22	Textile Mill Products	1.015	59	Miscellaneous Retail	1.244
23	Apparel & Other Finished Products Made From Fabric	1.015	60	Depository Institutions	1.266
24	Lumber & Wood Products, Except Furniture	1.343	61	Nondepository Credit Institutions	1.266
25	Furniture And Fixtures	1.275	62	Security & Commodity Brokers, Dealers, Exchanges	1.227
26	Paper And Allied Products	1.192	63	Insurance Carriers	1.336
27	Printing, Publishing And Allied Industries	1.264	64	Insurance Agents, Brokers And Service	1.336
28	Chemicals And Allied Products	1.119	65	Real Estate	1.604
29	Petroleum Refining And Related Industries	1.008	67	Holding And Other Investment Offices	1.227
30	Rubber And Miscellaneous Plastics Products	1.294	70	Hotels, Rooming Houses, Camps, ect.	1.369
31	Leather And Leather Products	0.954	72	Personal Services	1.218
32	Stone, Clay, Glass And Concrete Products	1.055	73	Business Services	1.724
33	Primary Metal Industries	0.816	75	Automotive Repair, Services & Parking	1.359
34	Fabricated Metal Products, Except Machinery & Tran	1.173	76	Miscellaneous Repair Services	1.724
35	Industrial And Commercial Machinery & Computer Equ	1.074	78	Motion Pictures	1.407
36	Electronic & Other Electrical Equipment & Componen	0.955	79	Amusement And Recreation Services	1.407
37	Transportation Equipment	1.125	80	Health Services	1.460
38	Measuring, Analyzing & Controlling Instruments	1.174	81	Legal Services	1.595
42	Motor Freight Transportation And Warehousing	1.194	82	Educational Services	1.252
44	Water Transportation	0.865	89	Services Not Elsewhere Classified	1.344

Source: BEA Regional Projections to 2040, U.S. Dept. of Commerce, June 1990

3. Area Source Emissions Growth Calculation

With the exception of gasoline marketing operations, the area source inventory was projected based on BEA data. In most cases, the factors used were those of employment or population growth. Guidance from EPA suggests that population or employment alone are not necessarily adequate indicators of emissions growth in comparison to income or value added growth. Because population and employment factors were the factors used to develop the emissions inventory, DEP believes they are the most appropriate factors to project growth.

The area source inventory is based primarily on employment and population emission factors. Emissions are calculated using a factor of a given number of pounds of pollutant per employee or per person. As this is the EPA approved method for calculating emissions to determine the Base Year Inventory, consistency dictates their use, where available, in projected year inventories. Other areas, such as air transport, where emissions are based on a measurable activity level, were considered on an individual basis and the best available factor was selected. See Table 7 for a comparison of activity indicators and growth indicators for area sources. The resulting growth factors, after applying the equation given in the Growth Factor Methodology section above, are detailed below.

Table 7 Area Source Growth Indicators

Source Category	Activity Indicator	Indicator of Growth	Source Category	Activity Indicator	Indicator of Growth
Transportation			*Combustion*		
RAILROADS	Fuel Consumption	Railroad Employment	FUEL OIL COMB	Fuel Consumption	Population
AIRCRAFT	LTO Cycles	Air Transport Employment	COAL CON (RES)	Fuel Consumption	Population
VESSELS	Fuel Consumption	Water Trans. Employment	NAT'L GAS & LPG	Fuel Consumption	Population
			STRUCTURE FIRE	Number of Fires	No Growth Projected
Industrial Processes			FOREST FIRES	Number of Fires	No Growth Projected
Surface Coating:			ORCHARD HEAT	Population	Population
AUTO REFINISH	Employment	Population			
TRAFFIC LINE P	Population	Population	*Gasoline Marketing*		
FACTORY FI WOOD	Employment	Durable Mfg. Employment	VOC-NO STAGE I	Fuel Sales	VMT
METAL FURN & FIX	Employment	Durable Mfg. Employment	STAGE I	Fuel Sales	VMT
ARCHITECT	Population	Population	STAGE II	Fuel Sales	VMT
ELECT INS	Employment	Durable Mfg. Employment	TANK BREATH	Fuel Sales	VMT
METAL CANS	Employment	Fabricated Metal Employment.	AIRCRAFT REFUEL	Fuel Sales	Air Transport Employment
MISC FI METALS	Employment	Fabricated Metal Employment.			
MACH & EQUIP	Employment	Nonelectric Machine Mfg. Employment	*Waste Disposal*		
APPLIANCES	Employment	Electric Machine Mfg. Employment	SOLID WASTE LF	Throughput	Population
MOTOR VEH	Employment	Motor Vehical Employment	POTW	Throughput	Population
OTHER TRANS	Employment	Transportation Employment	OPEN BURNING	Throughput	Population
MARINE	Employment	Durable Mfg. Employment	SOLID WASTE INC	Throughput	Population
MISC MANU	Employment	Durable Mfg. Employment			
HIGH PERF	Population	Durable Mfg. Employment	*Consumer/ Commercial*		
OTHER SPEC COAT	Population	Durable Mfg. Employment	DRY CLEANING	Population	Population
			COMM/CONS UM	Population	Population
Other Industrial:					
PESTICIDES	Land area	Farm Employment	*Misc. Evaporative*		
BIOPROCESS	Production	Population	ASPHALT	Populaion	Population
GRAPHIC ARTS	Population	Printing & Publishing Employment	LUST	Number of Tanks	Population
OFFSHORE	Population	No Growth Projected	CATASTROP HIC	Individual Records	No Growth Projected
DEGREASING	Employment	Durable Mfg. Employment			

Table 8 Area and Nonroad Growth Factors

Category	1983	1988	1990	1995	1996	1999	2000	2002	2005	'90-'05 Growth
Air Trans. Emp.	11.2	16.4	17.4	19.9	20.3	21.3	21.7	22.1	22.8	1.310
Auto Repair Emp.	49.8	65.4	67.6	73.2	74.2	77.0	78.0	79.3	81.2	1.201
Chemical Mfg. Emp.	58.1	60.1	59.8	59.2	59.2	59.1	59.1	58.8	58.4	0.976
Construction Emp.	233.9	319.2	323.1	332.9	334.8	340.4	342.3	344.0	346.5	1.072
Durable Mfg. Emp.	637.6	621.7	615.2	598.9	596.8	590.7	588.6	584.0	577.1	0.938
Electric Mach. Emp.	106.7	94.3	91.4	84.3	83.3	80.3	79.3	77.8	75.6	0.827
Fabricated Metal Emp.	87.9	94.9	95.5	97.1	97.3	97.7	97.9	97.5	96.9	1.014
Farm Employment	95.1	90.1	89.1	86.6	86.2	85.0	84.6	83.6	82.2	0.923
Food Mfg. Emp.	91.0	91.9	91.6	90.8	90.7	90.4	90.3	89.5	88.4	0.965
Furniture Employment	19.4	22.5	22.9	24.0	24.2	24.9	25.1	25.4	25.8	1.125
Lumber Prod. Emp.	22.5	35.3	36.4	39.1	39.6	41.0	41.5	42.1	43.0	1.182
Motor Vehicle Emp.	24.6	25.1	24.8	24.2	24.1	23.7	23.6	23.4	23.0	0.926
Nondurable Mfg. Emp.	480.6	460.5	458.2	452.5	452.3	451.7	451.5	449.1	445.4	0.972
Nonelectric Mach. Emp.	109.3	109.4	108.4	105.9	105.4	104.1	103.6	102.9	101.9	0.940
Petroleum Prod. Emp.	14.9	10.5	10.4	10.0	10.0	9.8	9.8	9.7	9.5	0.917
Primary Metal Emp.	121.0	91.3	87.5	78.0	76.8	73.2	72.0	70.0	67.0	0.766
Printing & Publish. Emp.	75.1	87.7	89.3	93.4	94.1	96.3	97.0	97.8	99.1	1.109
Railroad Employment	22.7	18.3	17.4	15.3	15.1	14.4	14.2	13.8	13.3	0.762
Retail Trade Emp.	910	1038	1056	1100	1110	1138	1148	1158	1174	1.112
Total Pop. (in thousands)	11895	12001	12091	12316	12356	12475	12515	12597	12719	1.052
Transportation Emp.	35.8	37.3	37.1	36.6	36.6	36.5	36.5	36.3	36.1	0.973
Water Trans. Emp.	7.1	5.1	5.0	4.6	4.6	4.4	4.4	4.3	4.2	0.847
Wholesale Trade Emp.	254.7	286.4	291.5	304.4	306.4	312.2	314.2	317.1	321.4	1.102

4. Nonroad Engine Emissions Growth Calculation

Growth in emissions from nonroad engines was calculated using the same methodology used for the area sources. Table 9 compares the activity level indicators used by the EPA with the growth indicators used here for projection. Growth factors are taken from the previous table.

Table 9 Comparison of Activity Level Indicators vs. Growth Indicators for Nonroad Engines

Category	Activity Indicator	Growth Indicator
Lawn and Garden Equipment	Single Family Homes and Landscaping Emp.	Population
Airport Service Equipment	Aircraft Operations	Employment
Recreational Equipment	Establishments in SIC 557 (Motorcycle Dealers)	Population
Recreational Marine Equipment	Boat Registration and Water Area	Population
Light Commercial Equipment	Wholesale Trade Establishments	Employment
Industrial Equipment	Employment	Employment
Construction Equipment	Employment	Employment
Agricultural Equipment	Employment	Employment
Logging Equipment	Logging Establishments	Employment

5. Highway Vehicle Emissions Growth Calculation

Highway vehicle emissions growth and, in the area source category, gasoline marketing growth are projected based on the projected increase in Vehicle Miles Traveled (VMT). This projection was derived from a Traffic Demand Model (TDM) and the Post Processor for Air Quality (PPAQ). For more information on this process see section 3.3.4 Highway Vehicle Sources in the 15% ROP Plan. Documentation is provided in Section G of this appendix.

6. Accounting For Growth In Emissions

Due to many factors - such as population increase, increases in spending and industrial production, increases in the number of miles people drive every year, and other factors - emissions would grow continually if left unchecked. This anticipated growth in emissions must be offset by various control measures in order for an area to meet its air quality goals.

As the table at the beginning of this section shows, the individual inventories for point, area, and nonroad sources experience positive growth, but emissions from highway vehicles are reduced without additional control measures between 1990 and 2005. The reason for this is that growth in highway vehicle emissions due to vehicle miles traveled emissions is completely compensated for by the Federal Motor Vehicle Control Program (FMVCP) and the nationwide use of lower volatility gasoline (vapor pressure of 9.0 psi). The FMVCP, in place prior to the passage of the 1990 CAA, which results in emission reductions due to newer, cleaner cars replacing older, less efficient vehicles in the general vehicle population, cannot be claimed as part of the required reduction. This is also true for the emission reductions due to the federal low volatility gasoline program.

Emission reductions from the FMVCP and low volatility gasoline, in place prior to 1990, are not creditable toward the ROP required reduction; therefore, other reductions in emissions from highway vehicles are necessary. These are described in the controlled inventory section.

C. VOC / NOx Ratio

The Clean Air Act (§182 (c) (2) (C)) recognizes that control of VOC alone may not always be the best solution for a region to meet attainment. Specifically allowed is the substitution of a certain amount of NOx reductions for, post 1996, *required* VOC reductions. A 1993 EPA memo entitled *NOx Substitution Guidance* released by the EPA Office of Air Quality Planning and Standards specifically allows substitution of a NOx reductions for VOC reductions provided that they produce equivalent progress towards attainment of the NAAQS.

The guidance above suggests that the total percentage reduction be calculated by the following formula:

$$(R_{VOC}/VOC_{Adjusted}) + (R_{NOx}/NOx_{Adjusted}) = R_{Total} \div VOC_{Adjusted}$$

Therefore, the following is also true:

$$R_{VOC} = ((R_{Total} \div VOC_{Adjusted}) - (R_{NOx} \div NOx_{Adjusted})) \times VOC_{Adjusted}$$

and

$$R_{Total} = R_{VOC} + (R_{NOx} \times (VOC_{Adjusted} \div NOx_{Adjusted}))$$

The above equations show that to convert NOx reductions to equivalent VOC reductions, the NOx reductions must be multiplied by the ratio of the respective milestone year's adjusted baseline inventory. This step is necessary because the target level of emissions is expressed only in terms of VOC.

The Adjusted Baseline inventories for VOC were listed above, the NOx adjusted baseline numbers were calculated using the same methodology as the VOC numbers and are as follows:

Table 10 Adjusted Baseline NOx Inventory

	1999	2002	2005
Point	161.90	161.90	161.90
Area	47.13	47.13	47.13
Nonroad	72.20	72.20	72.20
Highway Vehicle	138.80	135.57	134.29
Totals	420.03	416.80	415.52

This results in a VOC/NOx ratio calculation of:

Table 11 VOC/NOx Ratio Calculation

	1999	2002	2005
VOC Totals	576.11	572.30	570.74
NOx Totals	420.03	416.80	415.52
VOC/Nox Ratio	1.37	1.37	1.37

Coincidentally, the VOC/NOx ratio for all the years included in this plan is 1.37.

D. *Control Measure Credit Calculations*

This section provides a detailed description of the control measures and activities Pennsylvania will use to meet the Rate of Progress requirements. Information in the tables has been rounded to the nearest hundredth.

1. Point Source Controls

Table 12 Summary of Point Source VOC Controls

	1999	2002	2005
Reasonably Available Control Tech.	9.82	10.11	10.42
Rule Effectiveness	15.93	16.17	16.45
Shutdowns	2.38	2.59	2.79
Total	28.13	28.87	29.66

Table 13 Summary of Point Source NOx Controls

	1999	2002	2005
Reasonably Available Control Tech.	5.63	5.74	5.82
NOx MOU	27.37	30.82	34.20
Shutdowns	1.47	1.21	0.94
	34.37	37.77	40.96

a) NOx Allowance Program (The NOx MOU)

Background. NOx from large fossil fuel fired combustion units is a major contributor to regional ozone pollution. The Ozone Transport Commission (OTC) member states, including Pennsylvania, proposed development of a regional approach to address NOx emissions. Beginning in 1993, the Northeast States for Coordinated Air Use Management (NESCAUM), the Mid-Atlantic Regional Air Management Association (MARAMA), and EPA began working with the OTC to study the feasibility of implementing regional NOx emission reductions using an emission budget program throughout the northeast. Regional airshed modeling was used to identify the appropriate level of emission reductions that would contribute to a significant improvement in air quality.

As a result of these evaluations, the OTC proposed a second and third phase of NOx emissions reduction beyond that already achieved by the Reasonably Available Control Technology (RACT) program. The OTC in a Memorandum of Understanding (OTC MOU) formally adopted this recommendation in September of 1994. The OTC states, in the MOU of September 27, 1994, agreed to propose regulations for the control of NOx emissions in accordance with the following guidelines:

1. the level of NOx required would be established from a 1990 baseline emissions level;

2. the reduction would vary by location, or zone, and would be implemented in two phases utilizing a region-wide trading program; and

3. the reduction would be determined based on the less stringent of the following:

a. By May 1, 1999, the affected facilities in the inner zone shall reduce their combined rate of NOx emissions by 65%, or emit NOx at a rate no greater than 0.20 pounds per million BTUs;

b. By May 1, 1999, the affected facilities in the outer zone shall reduce the combined rate of NOx emissions by 55% from baseline, or shall emit NOx at a rate no greater than 0.20 pounds per million Btu;

c. By May 1, 2003, the affected facilities in the inner and outer zones shall reduce their combined rate of NOx emissions by 75% from baseline, or shall emit NOx at a rate no greater than 0.15 pounds per million Btu; and

d. By May 1, 2003, the affected facilities in the northern zone shall reduce their combined rate of NOx emissions by 55% from baseline, or shall emit NOx at a rate no greater than 0.20 pounds per million Btu.

In Pennsylvania, the counties of Berks, Bucks, Chester, Delaware, Montgomery and Philadelphia are in the inner zone; the remaining counties in Pennsylvania are in the outer zone.

In order to ensure that OTC states included common elements in the rules implementing the OTC MOU, the states worked through NESCAUM, MARAMA, and EPA to develop a model rule containing the common program elements. In addition to the state and federal representatives, the NESCAUM/MARAMA NOx budget task force was joined by an ad hoc committee comprised of representatives from industry, utilities, and environmental groups to ensure broad-based participation and consensus in the model rule.

The task force and ad hoc committee recognized that state program consistency is critical to the overall success of the NOx allowance program. State programs that are substantively identical in key areas will ensure that a ton of emissions reduced in one state is equivalent to a ton reduced in another state. Since states desire to promote cost effective compliance through intrastate and interstate emission trading, this level of consistency is essential to an effective trading program. The NESCAUM/MARAMA Model Rule meets these objectives and represents substantial consensus among the state and federal governmental representatives and the ad hoc committee members on key regulatory elements of a NOx allowance program to implement the OTC MOU.

The Model Rule applies to fossil-fuel fired combustion units with rated capacity of 250 MMBtu/hour or more and electric generating facilities of 15 megawatts or greater. Under this program, the OTC MOU emission reductions are applied to a 1990 baseline for NOx emissions in the Ozone Transport Region to create a "cap" on the emissions budget for the two target years: 1999 and 2003. The 1990 baseline was established through extensive work of the OTC, EPA, and industry to refine and quality assure the data available on actual NOx emissions for 1990. The 1990 emissions and budget for the OTC region has been desegregated to a state level and the states are allocating allowances to the facilities in the program. Beginning in 1999, the sum of NOx emissions from affected sources during the May 1 through September 30 control period cannot exceed the equivalent number of allowances allocated in the region. An allowance is equal to one ton of NOx emissions. NOx-affected sources must hold allowances for all NOx emitted during the ozone season months of May through September, and NOx-affected sources are allowed to buy, sell or trade allowances as needed.

The Department worked closely with the affected sources and the Air Quality Technical Advisory Committee to develop the state regulations and specific allocations.

Implementation. The final NO_x Allowance Requirements were published as final regulations on November 1, 1997, in the Pennsylvania Bulletin. Affected sources are required to submit monitoring plans and begin monitoring during 1998. Compliance with the emission reduction requirements is required by May 1, 1999. The Environmental Protection Agency, Acid Rain Division, will do tracking of emissions at a central location for all states in the OTC. The Department is responsible for enforcement of the control program.

Reductions. The NOx Allowance Requirements affect fourteen facilities in the Pennsylvania counties of the Philadelphia Interstate Ozone Nonattainment Area. These facilities and their reductions are listed in Section F of this appendix.

b) Reasonably Available Control Technology (RACT)

Background. The CAA requires states to adopt regulatory programs mandating those major stationary sources of VOCs and NOx located in ozone nonattainment areas implement RACT control strategies. These RACT control efforts were to be completed by the affected sources as "expeditiously as practicable" but no later than May 31, 1996. The RACT requirements apply both to sources affected by the provisions of Control Techniques Guidance (CTG) documents issued by EPA and other major stationary sources. In the Philadelphia ozone nonattainment area, a major stationary source is one that has the "potential to emit" either VOCs or NOx at a rate equal to or greater than 25 tons per year.

RACT is a generic term which includes the variety of controls which are available for use to reduce emissions from a source or class of sources that are cost effective. EPA has issued CTGs for approximately 25 to 30 classes of sources of VOCs and plans to issue approximately 15 more. The Commonwealth has adopted regulations incorporating the CTG requirements for the classes of sources that are represented in Pennsylvania and has in appropriate cases submitted permits as revisions to the SIP for affected sources. In a series of regulatory revisions in the early 1990's, the Commonwealth made the CAA-mandated RACT fix-ups.

EPA has not issued CTGs to define RACT controls for sources of NOx and has no plans to do so. However, EPA has issued a number of Available Control Techniques guidance documents for certain classes of NOx sources. The NOx guidance documents differ from the VOC CTG documents in that they do not define a presumptive norm for the control requirements, as the CTGs do.

Implementation. Because of the wide variety and disparate ages of the sources located in the Commonwealth, Pennsylvania has determined that the preferred approach to regulation of major stationary sources of VOC and NOx for which CTG-based regulations are not in place is through a "case-by-case" RACT regulatory program. The program also includes presumptive RACT for most types of NOx sources, which operators may elect instead of using the case-by-case approach. Major stationary sources have developed analyses of available technologies for the reduction of the affected pollutants, submitted the analyses to the Department of Environmental Protection for review, approval, or modification, and have implemented approved RACT plans. The case-by-case determinations have been submitted as revisions to the Pennsylvania SIP. For details on the Pennsylvania RACT program, refer to 25 PA. Code §§129.91-129.95.

Reductions. Sources included for ROP credit in the NOx RACT program are only those that are not covered by the NOx MOU. These sources and their reductions are listed in Section F of this appendix.

c) Source and Process Shutdowns

Background and Implementation. Several sources, which were operational in 1990 and were included in the inventory, have since shutdown. Sources that did not apply to bank emission reduction credits (ERCs) within the regulatory deadlines established in 25 Pa. Code § 127.207(2), and therefore the listed reductions can be credited as permanent and enforceable emission decreases.

In addition, Pennsylvania regulations require a 1.3:1 offset ratio for banked emissions. Therefore, sources that have banked emissions under 25 Pa. Code §127 (Subchapter E) may use no more than 77% of these emissions at a later date. The remaining 23% are permanent reductions.

Reductions: The facilities for which ROP credit is claimed and the amount of credit are listed in Section F of this appendix.

2. Summary of Area Source Controls

Table 14 Area Source VOC Controls

VOC Reductions	1999	2002	2005
AIM	7.33	7.38	7.43
Autobody	6.01	6.07	6.12
Consumer Products	6.64	6.71	6.77
Stage II	17.71	19.82	21.25
TSDF	9.52	9.61	9.70
	47.21	49.59	51.27

Section G of this appendix contains emissions by county and area source category for uncontrolled levels as well as the control percentage applied to each category used to estimate the above reductions. Section G also applies the percentages, as a sample calculation, to the 2005 milestone year.

a) Architectural and Industrial Maintenance Coatings

Background. The CAA requires EPA to adopt regulations for certain VOC-containing coatings. The ongoing national regulatory negotiation for Architectural and Industrial Maintenance (AIM) coatings is in the process of defining the final requirement.

AIM coatings are field-applied coatings used by industry, contractors, and homeowners to coat houses, buildings, highway surfaces, and industrial equipment for decorative and protective purposes. The different types of coatings include flat, non-flat, and numerous specialty coatings. .VOC emissions result from the evaporation of solvents from the coatings during application and drying.

Because the category consists primarily of non-shop-applied coatings, the only technically and economically feasible control strategies involve product reformulation. This can involve one or more of the following approaches:

* Replacing VOC solvents with non-reactive substitutes.
* Increasing the amount of solids.
* Altering the chemistry of the resin so less solvent is needed for the required viscosity.
* Switching to waterborne latex or a water soluble resin system.

Implementation. This is a pending federal measure.

Reductions. Based upon EPA guidance, an emissions reduction of 15 percent could be applied towards the requirements for the Rate of Progress plan. The reductions were calculated as follows:

Reduction = Projected Emissions x 15%

The projected emissions were summed from the categories of Architectural Coatings, Special Purpose Coatings and High Performance Coating.

b) Stage II Vapor Recovery

Background. This control measure involves the installation of Stage II vapor recovery nozzles at gasoline pumps. This will reduce emissions of vapors in the fuel tank that are displaced by incoming gasoline.

This strategy also includes reductions from the federal Onboard Vapor Recovery Program which requires onboard refueling emissions controls for passenger cars and light trucks. Additional reductions are gained over time as the federal onboard vapor recovery controls on new vehicles replace older uncontrolled vehicles. This program will be phased-in over three model years with 40 percent, 80 percent, and 100 percent of new car production being required to meet the standard in model years 1998, 1999, and 2000 respectively.

Implementation. Implementation of Stage II vapor recovery systems in the five county Philadelphia area was mandated in section 6.7(e) of the Air Pollution Control Act (35 P.S. § 4005(a)(1)). See also 25 Pa. Code §129.82.

Installation of Onboard Vapor Recovery systems is mandated by §202(a)(6) of the Clean Air Act Amendments and by 59 FR 16262, dated April 6,1994.

Uncontrolled emissions for refueling emissions have an emission factor of 11.7 lbs. per 1000 gallons, according to Appendix IV of AP42. This factor was obtained by adding the Stage II emission factor with the spillage emission factor. The Department of Revenue provided fuel sales for 1990 for the Commonwealth of Pennsylvania. The fuel sales were apportioned by county based on the percentage of VMT of the county to the state, projected to the milestone years based on growth in VMT expected by PennDOT.

FUEL SALES (in thousand Gal.)

County	1990	1999	2002	2005
BUCKS	666	758	782	806
CHESTER	526	598	617	636
DELAWARE	429	488	504	519
MONTGOMERY	872	993	1,024	1,056
PHILADELPHIA	854	972	1,003	1,034
	3,346	3,809	3,930	4,051

Mobile 5B was used to determine the emission factor for controlled Stage II. The assumptions were 95% Rule Penetration and 80% Rule Effectiveness. This produces a 76% efficiency which was used as an input along with the start year of 1993 and a phase in period of 2 years into the Mobile 5B input file of the projected control strategies. In addition, Mobile5B was instructed to include reductions for the onboard vapor recovery systems. This resulted in the emission factors in the below table. For convenience, these factors have been converted into pounds per thousand gallons.

	1999	2002	2005
Controlled EF (g/gal)	1.09	0.73	0.55
Controlled EF (lbs/ 10^3 gal)	2.40	1.61	1.21

Reductions. The following table summarizes the emission reductions from this plan.

Emissions	1999	2002	2005
Uncontrolled	22.28	22.99	23.70
Controlled	4.57	3.16	2.45
Reductions	17.71	19.83	21.25

The following sample calculation details the process used to determine the 1999 emission reductions. (The result of this calculation may be ± .01 due to rounding.)

Emission Factor Calculation:

$$EF_{no\ Stage\ II} = \frac{11.7lbs}{1000gal}$$

$$Efficiency = RE \times RP = .80 \times .95 = 76\%$$

$$EF_{Stage\ II} = 1.09\ {}^{g}\!/_{gal} \times \frac{kg}{1000g} \times 2.205\ {}^{lbs}\!/_{kg} \times {}^{1000gal}\!/_{10^3\,gal} = \frac{2.40lbs}{10^3\,gal}$$

Emission Reduction Calculation

$$99\,Emis_{No\,Stage\,II} = EF_{No\,Stage\,II} \times Gallons\,Sold_{1999\,Daily}$$

$$= 11.7\,{}^{lbs}\!/_{10^3\,gal} \times 3{,}809\;10^3\,gal \times \frac{1ton}{2000lbs} = 22.28tons$$

$$99\,Emis_{Stage\,II} = EF_{Stage\,II} \times Gallons\,Sold_{1999\,Daily}$$

$$= 2.40\,{}^{lbs}\!/_{10^3\,gal} \times 3{,}809\;10^3\,gal \times \frac{1ton}{2000lbs} = 4.58tons$$

$$\mathrm{Re}\,ductions = 99\,Emis_{No\,Stage\,II} - 99\,Emis_{Stage\,II}$$

$$= 22.28tons - 4.58tons = 17.71tons$$

c) Treatment, Storage, and Disposal Facilities Treatment, Storage, and Disposal Facilities (TSDFs)

Background. Treatment, storage and disposal facilities (TSDFs) manage hazardous wastes containing VOCs and hazardous air pollutants (HAPs). These facilities manage dilute wastewaters, organic and inorganic sludges, and organic and inorganic solids. The waste disposal is accomplished by incineration, land treatment, underground injection, or landfills.

Implementation. This is a federally implemented measure.

Reductions. Phase I standards were promulgated on June 21, 1990. The Phase II standards, promulgated on December 8, 1997 control emissions by 93%. This control level, with an 80% rule effectiveness factor, was used to calculate the emission reductions.

d) Autobody Refinishing

Background. EPA is in the process of adopting regulations controlling emissions from coatings used in autobody refinishing. These coatings are typically shop-applied coatings used by industry, small businesses, and vehicle owners to repair or recondition vehicles. VOC emissions result from the evaporation of solvents from the coatings during the following steps:

* Surface Preparation
* Surface Coating Application
* Cleaning of Application Equipment

There are several methods currently available to reduce emissions. The VOC content of surface preparation products is approximately 6.75 lbs/gal. There are products available with VOC levels below 1.7 lbs/gal. Similar reductions are also feasible from the reformulation of the surface coatings, including sealers and topcoats. High-efficiency transfer spray systems have been shown to reduce emissions by 20-40%. Another technique is to install spray-gun-cleaning equipment at body shops - this has been shown to reduce equipment-cleaning emissions by 88%, and is already in use in many autobody repair shops.

The pending federal measure targets the surface coatings. These are responsible for approximately 70% of the emissions in this source category.

Implementation. This is a pending federal measure.

Reductions. Reductions from the reformulation of surface coatings are expected to be at least 37%. Because this rule affects a limited number of manufacturers, RE adjustments are not required.

e) Consumer Products

Background. The CAA requires EPA to establish regulations controlling emissions from consumer products. These include items sold for household, personal, and automotive use that contain VOCs. There are several definitions of consumer products. For the purpose of the pending federal measure they are considered to be any VOC-containing products in one of the previously mentioned categories, with the exception of aerosol paints.

Although the sources in this category are widely geographically disbursed, there are still several effective alternatives for controlling emissions from this category. These include:

* Product Reformulation
* Use of non-VOC Propellants (including CO2, compressed air and HFC- 152a)
* Use of alternative delivery systems (i.e. handpumps or solids)
* Product Substitution

Implementation. This is a pending federal measure.

Reductions. Reductions from this measure are expected to be at least 25%. After application of the default rule effectiveness factor, a 20% reduction should be applied towards the requirements for the Rate of Progress plan. The reductions were calculated as follows:

Percent Reduction (R): 25%
Default Rule Effectiveness (RE): 80%

3. Highway Vehicle Source Controls

Table 15 Summary of Highway Vehicle VOC Controls

	1999	2002	2005
Federal Motor Vehicle Control Program	6.92	13.06	20.38
Enhanced I/M	59.28	62.04	66.14
Reformulated gasoline (RFG)	22.41	35.17	36.19
TOTAL	88.61	110.27	122.71

Table 16 Summary of Highway Vehicle NOx Controls

	1999	2002	2005
Federal Motor Vehicle Control Program	14.84	23.38	28.13
Enhanced I/M	32.29	32.77	33.94
Reformulated gasoline (RFG)	0.43	5.74	5.40
TOTAL	47.56	61.89	67.47

Reductions are calculated through the use of the MOBILE model. Documentation for the emission reductions above is provided in Section H.

a) The Federal Motor Vehicle Control Program (FMVCP) and Tier I Vehicle Emissions Standards

Background. The CAA requires new federal motor vehicle emissions standards, called "Tier I Standards," to be phased in beginning in the 1994 model year. This program is being implemented by the federal government and affects light-duty vehicles and trucks. This program requires more stringent exhaust emission standards as well as a uniform level of evaporative emission controls, demonstrated through the new federal evaporative test procedures.

Implementation. This is a federally implemented measure.

b) Enhanced Vehicle Inspection and Maintenance (I/M)

Background. This measure involves implementing an enhanced vehicle inspection and maintenance (I/M) program, with requirements stricter than the program that has been in place since 1984. The concept behind I/M is to ensure that cars are properly maintained in customer use. Today's cars are dependent on properly functioning emission controls to keep pollution levels low. Minor malfunctions in the emission control system can increase emissions significantly, while major malfunctions can cause emissions to skyrocket. However, malfunctions are often not obvious to the driver. Therefore, a program that requires light-duty vehicles to be inspected periodically and, if necessary, repaired, can greatly reduce vehicle emissions.

The Clean Air Act Amendments of 1990 required the Commonwealth to implement an enhanced I/M program. Subsequently, in December 1995, Congress enacted the National Highway Systems Designation Act (NHS) which provided the opportunity for states to redesign their I/M programs and submit them to EPA by March 26, 1996. Once granted interim approval, states have 18 months to prove their effectiveness based on actual operation of the system. Amendments to the Motor Vehicle Code (Act 72), enacted December 15, 1995, provide the Commonwealth with the legislative authority to implement the decentralized test and repair program. Pennsylvania made its NHS submission on March 22, 1996 and received interim conditional approval on January 28, 1997.

Implementation. The Commonwealth began its enhanced decentralized program on October 1, 1997. The program will meet EPA's high-enhanced I/M standard. Annual inspections are conducted at service stations or dealers by certified inspectors in conjunction with the safety inspection. Vehicles to be tested include gasoline-fueled cars and trucks of model year 1975 or newer that are 9,000 pounds or under. Some vehicles, such as antiques, classics and vehicles driven less than 5,000 miles per year, are exempt. The Commonwealth will certify all testing facilities.

Substantially more sophisticated testing equipment is being used than the program in place before 1997. System enhancements will significantly improve inspection station and motorist compliance. A safety inspection sticker cannot be issued to effected vehicles until the vehicle receives an emission sticker. Data system enhancements at the inspection stations improve the timeliness of data collection to enable the Commonwealth to determine problem stations and identify potential candidates for additional audits. Hands-on training for inspection and repair technicians with a continuing education component is being provided. Since the program's emphasis is on effective repair, a certification program for repair technicians (in addition to inspectors) has been established.

c) Reformulated Gasoline

Background. This program requires the use of lower-polluting reformulated gasoline (RFG) in the Philadelphia Interstate Ozone Nonattainment Area. This will affect all gasoline-powered vehicles and will also reduce evaporative emissions from service stations.

At a minimum, Phase I reformulated gasoline (available from January 1, 1995 through December 31, 1999) must not cause an increase in NOx emissions. Phase I RFG must also have an oxygen content of at least 2.0 percent by weight, have a benzene content no greater than 1.0 percent by volume, contain no heavy metals, and contain detergents. Most importantly, the Act requires a reduction in VOC and toxic emissions of 15 percent over baseline levels beginning in 1995 and 25 percent beginning in the year 2000.

Phase II reformulated gasoline will become available on Jan. 1, 2000. Use of this fuel will result in greater reductions of VOC and toxic emissions. In addition, the Phase II program requires a 5-7% reduction in NOx levels from the 1990 levels. Because MOBILE 5aH does not enable Phase II NOx reductions to be modeled, MOBILE 5b was used to estimate these reductions.

Implementation. This is a federally implemented measure. This program began on January 1, 1995.

4. Nonroad Engine Control Measures

Table 17 Summary of Nonroad Engine VOC Controls

	1999	2002	2005
Spark Engines	N/A	N/A	15.79

Table 18 Nonroad Engine NOx Controls

	1999	2002	2005
Compression Engines	N/A	N/A	44.00

a) Compression-Ignition Engines

Background. Under current EPA Regulations[1] nonroad compression ignition (diesel) engines greater than 50 horsepower (hp), which are not used in under-ground mining, locomotives and marine vessels, must comply with Tier 1 emission standards which are being phased in between 1996 and 2005. EPA predicts reductions in NOx from the Tier 1 standard should exceed 30%.

Implementation. EPA issued a notice of proposed rulemaking in the fall of 1997 that will lead to increased reductions in NOx emission from the Tier 1 levels, and implement controls on engines less than 50hp (except for the exempt categories listed above). This regulation is expected to result in a further 60% reduction in NOx emissions[2].

Reductions. Calculation of emission reductions from the Tier 1 standards is not possible because the current inventory methods only provide an average horsepower for a class of engines, and no method for determining what percentage are greater than 50hp. For this reason, the DEP did not attempt to quantify the reductions under Tier 1. It is hoped that forthcoming EPA models will provide a technique to estimate this credit.

The further reductions in NOx from nonroad engines is easier to estimate because it is only necessary to differentiate engines by type (diesel or spark-ignited) rather than horsepower rating. A review of the EPA provided data shows that NOx emissions from engines in the *Construction Equipment*, *Industrial Equipment* and *Agricultural Equipment* categories are overwhelmingly the product of diesel engines. The DEP

[1] 40 CFR Parts 85-89, June 17, 1994

[2] *Summary of EPA's Nonroad Engine Control Programs*, EPA Environmental Fact Sheet, February 1997.

believes that, pending better guidance, it is reasonable to estimate these reductions by applying the 60% control level to the pre Tier 1 NOx emissions in those categories.

Phase-in of the new equipment will begin with the 1999 model year. DEP has calculated the reductions by not assuming any credit until the 2005 year and assuming full implementation at that time.

b) Spark Ignition Engines

Background and Implementation. Under Phase 1 of EPA's regulations, new small spark-ignition (SI) engines -- usually gasoline fueled- with a power of at or below 25 hp will need to reduce hydrocarbon (HC) emissions by 32%[3]. In addition to these regulations, EPA proposed Phase 2 in December 1997. The final Phase 2 rule should result in emissions reductions of HC and NOx of approximately 30% beyond those achieved in Phase 1. Currently, SI engines over 25 hp are not regulated, although EPA has stated that they intend to work with the industry to develop a statement of principles that would establish controls.

Reductions. Calculating the reductions from Phase 1 control of SI engines is, much like diesel engines, complicated by the lack of an inventory that is broken down by engine horsepower. After review of the inventory data, it was found that engine types that *average* above 25hp produced only 2% of the emissions of VOCs (hydrocarbons) from the lawn and garden engine category. This suggests that if the 32% control level from Phase 1 is applied to the entire lawn and garden engine category, could over-estimate reductions by no more than approximately one third of a ton.

DEP feels that it is reasonable to project controls based on the 32% reduction being applied to the entire lawn and garden category. This is because the error introduced is certainly offset by reductions from other small SI engines for which no credit is claimed. To account for a phase-in of this program, no credit is being claimed until 2005, at which time full implementation is assumed.

Because manufacture of Phase 2 compliant engines may not begin, at some facilities, until 2005, the program is unlikely to produce significant reductions before then. For this reason, no credit from Phase 2 or the proposed statement of principles is currently being assumed.

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[3] *Ibid.*

E. *Summary Totals of Inventory Data*

The following tables summarize the inventory data contained in this appendix. The summations in this section may be ± .01 due to rounding.

1. VOC Inventory:

Uncontrolled	1999	2002	2005
Point	162.50	165.82	169.13
Area	202.86	205.11	207.23
Nonroad	82.63	83.22	83.79
Highway Vehicle	176.86	180.33	186.94
Totals	624.84	634.48	647.08

Controlled	1999	2002	2005
Point	134.36	136.90	139.46
Area	155.65	155.52	155.95
Nonroad	82.63	83.22	68.00
Highway Vehicle	88.24	70.06	64.23
	460.87	445.70	427.64

2. NOx Inventory

Uncontrolled	1999	2002	2005
Point	177.49	182.18	186.86
Area	47.01	47.10	47.16
Nonroad	74.37	74.76	74.96
Highway Vehicle	156.40	157.31	160.22
Totals	455.27	461.35	469.20

Controlled	1999	2002	2005
Point	143.03	144.46	145.89
Area	47.01	47.10	47.16
Nonroad	74.37	74.76	30.96
Highway Vehicle	108.84	95.42	92.75
	373.25	361.74	316.76

Appendix III

F. Point Source Credit Documentation:

- Inventory Totals
- RACT
- Rule Effectiveness
- NOx MOU
- Shutdowns

Philadelphia Phase II Plan
Credits for 1999, 2002, 2005

Tons per Summer Day

NOx Point Source Totals

County	1999 w/o	1999 w	2002 w/o	2002 w	2005 w/o	2005 w
Bucks	15.66	14.43	15.59	14.45	15.52	14.47
Chester	31.06	23.34	32.40	24.06	33.73	24.77
Delaware	72.43	50.90	74.71	51.16	76.99	51.43
Montgomery	8.13	8.19	8.29	8.34	8.45	8.48
Philadelphia	50.21	46.17	51.19	46.45	52.17	46.74
	177.49	143.03	182.18	144.46	186.86	145.89

VOC Point Source Totals

County	1999 w/o	1999 w	2002 w/o	2002 w	2005 w/o	2005 w
Bucks	24.54	17.21	25.35	17.81	26.16	18.41
Chester	18.73	14.64	19.44	15.21	20.16	15.78
Delaware	70.72	57.98	71.58	58.64	72.44	59.30
Montgomery	8.59	8.49	8.84	8.74	9.08	8.98
Philadelphia	39.92	36.04	40.61	36.50	41.29	36.99
	162.50	134.36	165.82	136.90	169.13	139.46

NOx RACT

Company	County	NEDS ID	1999 w/o	1999 w	2002 w/o	2002 w	2005 w/o	2005 w
PECO Energy, Cromby	Chester	0023	0.03	0.02	0.04	0.02	0.04	0.02
Transcontinental Pipeline	Chester	0047	13.40	9.78	14.03	10.32	14.66	10.86
Sun Refining & Marketing	Delaware	0025	6.86	4.87	6.88	4.88	6.89	4.90
Philadelphia Baking	Philadelphia	3048	0.02	0.01	0.02	0.01	0.02	0.01
			20.31	14.68	20.97	15.23	21.61	15.79

VOC RACT

Company	County	NEDS ID	1999 w/o	1999 w	2002 w/o	2002 w	2005 w/o	2005 w
Fasson-Div of Avery	Bucks	0040	12.58	6.04	13.01	6.27	13.43	6.49
PECO Energy - Cromby	Chester	0023	0.08	0.05	0.09	0.05	0.09	0.05
ICI/LNP	Chester	0057	0.56	0.29	0.58	0.31	0.61	0.32
Norwood Industries	Chester	0042	2.72	0.60	2.81	0.62	2.91	0.64
Philadelphia Baking	Philadelphia	3048	0.23	0.11	0.23	0.11	0.24	0.11
Nabisco	Philadelphia	3201	0.40	0.07	0.41	0.07	0.41	0.07
Continental Baking	Philadelphia	5811	0.52	0.11	0.52	0.11	0.53	0.12
			17.09	7.27	17.65	7.54	18.22	7.80

Rule Effectiveness

Company	County	NEDS ID	1999 w/o	1999 w	2002 w/o	2002 w	2005 w/o	2005 w
Pre Finish Metals, Inc	Bucks	0004	1.21	0.82	1.24	0.85	1.28	0.87
Paramount Packaging	Bucks	0008	0.81	0.56	0.84	0.59	0.88	0.62
Cleveland Steel Container	Bucks	0038	0.05	0.04	0.06	0.04	0.06	0.04
Dunmore Corporation	Bucks	0079	0.27	0.16	0.27	0.16	0.27	0.16
NVF Co.	Chester	0005	3.14	1.67	3.29	1.76	3.44	1.86
Reynolds Metals Co.	Chester	0046	1.17	0.99	1.22	1.04	1.28	1.09
Congoleum Corp.	Delaware	0049	33.27	20.82	33.77	21.15	34.26	21.47
Brown Printing Co.	Montgomery	0115	0.22	0.12	0.23	0.13	0.24	0.14
Allied Chemical Corp	Philadelphia	1551	2.19	1.88	2.24	1.93	2.29	1.97
Kurz-Hastings Inc.	Philadelphia	1585	5.05	4.39	5.12	4.46	5.20	4.53
			47.38	31.45	48.28	32.11	49.20	32.75

NOx MOU

Company	County	NEDS ID	1999 w/o	1999 w	2002 w/o	2002 w	2005 w/o	2005 w
PECO Energy - Croyden	Bucks	0006	5.56	5.16	5.83	5.16	6.09	5.16
US Steel Corp	Bucks	0055	2.39	2.79	2.30	2.79	2.21	2.79
PECO Energy - Cromby	Chester	0023	11.08	6.98	11.60	6.98	12.12	6.98
PECO Energy - Eddystone	Delaware	0014	41.24	26.79	43.19	26.79	45.13	26.79
Kimberly-Clark	Delaware	0016	1.17	1.09	1.21	1.09	1.25	1.09
Sun Refining & Marketing	Delaware	0025	2.73	1.56	2.74	1.56	2.74	1.56
BP Oil, Inc.	Delaware	0030	5.33	1.72	5.35	1.72	5.36	1.72
Merck Sharp & Dohme	Montgomery		0.64	0.70	0.66	0.70	0.67	0.70
PECO Energy - Delaware	Philadelphia	4901	6.70	7.51	7.02	7.51	7.33	7.51
Philadelphia Thermal-Sansom	Philadelphia	4902	1.83	1.63	1.92	1.63	2.01	1.63
PECO Energy	Philadelphia	4903	0.43	0.70	0.45	0.70	0.47	0.70
PECO Energy - Schuylkill	Philadelphia	4904	2.82	0.87	2.96	0.87	3.09	0.87
Philadelphia Thermal-Schuylkill	Philadelphia	4942	2.95	0.00	3.09	0.00	3.23	0.00
Grays Ferry	Philadelphia	9999	1.49	1.49	1.49	1.49	1.49	1.49
U.S. Navy Base	Philadelphia	9702	0.00	0.00	0.00	0.00	0.00	0.00
			86.36	58.99	89.81	58.99	93.19	58.99

NOx Shutdown

Company	County	NEDS ID	1999 w/o	1999 w	2002 w/o	2002 w	2005 w/o	2005 w
US Steel Corp	Bucks	0055	6.89	5.67	6.63	5.67	6.36	5.67
Sun Refining & Marketing	Delaware	0025	0.89	0.64	0.89	0.64	0.89	0.64
			7.78	6.31	7.52	6.31	7.25	6.31

VOC Shutdown

Company	County	NEDS ID	1999 w/o	1999 w	2002 w/o	2002 w	2005 w/o	2005 w
Rohm & Haas Delaware	Bucks	0009	0.09	0.07	0.09	0.07	0.09	0.07
US Steel Corp	Bucks	0055	0.05	0.05	0.05	0.05	0.05	0.05
Quebecor Printing	Chester	0009	3.68	3.68	3.84	3.84	4.01	4.01
Sun Refining & Marketing	Delaware	0025	0.16	0.12	0.16	0.12	0.16	0.12
BP Oil, Inc.	Delaware	0030	1.95	1.90	1.96	1.90	1.96	1.90
Congoleum Corp.	Delaware	0049	1.32	1.12	1.34	1.12	1.36	1.12
Sun Refining & Marketing	Philadelphia	1501	2.64	2.60	2.64	2.60	2.65	2.60
Rohm & Haas Delaware	Philadelphia	1531	0.42	0.37	0.43	0.37	0.44	0.37
Allied Chemical Corporation	Philadelphia	1551	4.91	4.26	5.02	4.26	5.13	4.26
Crown Cork & Seal	Philadelphia	1555	1.14	0.93	1.18	0.93	1.21	0.93
Progress Lighting Co.	Philadelphia	1584	0.05	0.04	0.05	0.04	0.05	0.04
Acme Markets	Philadelphia	2002	0.05	0.00	0.05	0.00	0.05	0.00
SKF Ind.	Philadelphia	2067	0.26	0.00	0.26	0.00	0.27	0.00
Schneider Bros. Co.	Philadelphia	3292	0.15	0.00	0.16	0.00	0.16	0.00
Monarch MFG Works Inc.	Philadelphia	3492	0.08	0.00	0.08	0.00	0.09	0.00
Craft-Bilt Co.	Philadelphia	3551	0.15	0.00	0.15	0.00	0.15	0.00
Container Recyclers	Philadelphia	5112	0.10	0.00	0.10	0.00	0.10	0.00
Quality Container Company	Philadelphia	5116	0.13	0.00	0.14	0.00	0.14	0.00
U.S. Naval Base	Philadelphia	9702	0.47	0.35	0.47	0.35	0.47	0.35
U.S. Mint	Philadelphia	9703	0.07	0.00	0.07	0.00	0.07	0.00
			17.87	15.49	18.24	15.65	18.61	15.82

Appendix III

G. Area/Nonroad Source Documentation

Area Source NOx Emissions

County	Group	Category	emis99	emis02	emis05	Control %	Control	Growth Key
BUCKS	Combustion	FUEL OIL COMBUSTION (COMM +	2.05	2.07	2.09	0%	NONE	Population
BUCKS	Combustion	COAL COMBUSTION	0.11	0.11	0.11	0%	NONE	Population
BUCKS	Combustion	NATURAL GAS & LPG	0.81	0.81	0.82	0%	NONE	Population
BUCKS	Miscellaneous Area Sources	STRUCTURE FIRES	0.04	0.04	0.04	0%	NONE	None
BUCKS	Miscellaneous Area Sources	FOREST FIRES	0.00	0.00	0.00	0%	NONE	None
BUCKS	Transportation	AIRCRAFT	0.01	0.01	0.01	0%	NONE	Air Trans Emp
BUCKS	Transportation	RAILROADS	1.81	1.73	1.67	0%	NONE	Railroad Emp
BUCKS	Waste Disposal, Treatment &	OPEN BURNING	0.01	0.01	0.01	0%	NONE	Population
BUCKS	Waste Disposal, Treatment &	SOLID WASTE INCINERATION	0.25	0.25	0.25	0%	NONE	Population
BUCKS Total			5.08	5.04	5.00			
CHESTER	Combustion	NATURAL GAS & LPG	0.[illegible]	0.47	0.47	0%	NONE	Population
CHESTER	Combustion	FUEL OIL COMBUSTION (COMM +	1.45	1.47	1.48	0%	NONE	Population
CHESTER	Combustion	COAL COMBUSTION	0.12	0.12	0.12	0%	NONE	Population
CHESTER	Miscellaneous Area Sources	FOREST FIRES	0.00	0.00	0.00	0%	NONE	None
CHESTER	Miscellaneous Area Sources	STRUCTURE FIRES	0.03	0.03	0.03	0%	NONE	None
CHESTER	Transportation	RAILROADS	0.55	0.53	0.51	0%	NONE	Railroad Emp
CHESTER	Transportation	AIRCRAFT	0.01	0.01	0.01	0%	NONE	Air Trans Emp
CHESTER	Waste Disposal, Treatment &	OPEN BURNING	0.01	0.01	0.01	0%	NONE	Population
CHESTER	Waste Disposal, Treatment &	SOLID WASTE INCINERATION	0.17	0.17	0.17	0%	NONE	Population
CHESTER Total			2.80	2.80	2.80			
DELAWARE	Combustion	NATURAL GAS & LPG	1.70	1.72	1.74	0%	NONE	Population
DELAWARE	Combustion	COAL COMBUSTION	0.04	0.04	0.04	0%	NONE	Population
DELAWARE	Combustion	FUEL OIL COMBUSTION (COMM +	1.52	1.54	1.55	0%	NONE	Population
DELAWARE	Miscellaneous Area Sources	STRUCTURE FIRES	0.04	0.04	0.04	0%	NONE	None
DELAWARE	Transportation	RAILROADS	2.16	2.07	1.99	0%	NONE	Railroad Emp
DELAWARE	Transportation	AIRCRAFT	1.74	1.81	1.86	0%	NONE	Air Trans Emp
DELAWARE	Waste Disposal, Treatment &	OPEN BURNING	0.01	0.01	0.01	0%	NONE	Population
DELAWARE	Waste Disposal, Treatment &	SOLID WASTE INCINERATION	0.22	0.22	0.22	0%	NONE	Population
DELAWARE Total			7.43	7.44	7.45			
MONTGOMERY	Combustion	NATURAL GAS & LPG	1.98	2.00	2.02	0%	NONE	Population
MONTGOMERY	Combustion	COAL COMBUSTION	0.18	0.19	0.19	0%	NONE	Population
MONTGOMERY	Combustion	FUEL OIL COMBUSTION (COMM +	2.33	2.35	2.38	0%	NONE	Population
MONTGOMERY	Miscellaneous Area Sources	STRUCTURE FIRES	0.05	0.05	0.05	0%	NONE	None
MONTGOMERY	Miscellaneous Area Sources	FOREST FIRES	0.00	0.00	0.00	0%	NONE	None
MONTGOMERY	Transportation	RAILROADS	2.63	2.52	2.43	0%	NONE	Railroad Emp
MONTGOMERY	Transportation	AIRCRAFT	1.42	1.47	1.52	0%	NONE	Air Trans Emp
MONTGOMERY	Waste Disposal, Treatment &	SOLID WASTE INCINERATION	0.38	0.38	0.39	0%	NONE	Population
MONTGOMERY	Waste Disposal, Treatment &	OPEN BURNING	0.02	0.02	0.02	0%	NONE	Population
MONTGOMERY Total			8.99	8.99	8.98			
PHILADELPHIA	Combustion	NATURAL GAS & LPG	7.19	7.26	7.33	0%	NONE	Population
PHILADELPHIA	Combustion	COAL COMBUSTION	0.44	0.45	0.45	0%	NONE	Population
PHILADELPHIA	Combustion	FUEL OIL COMBUSTION (COMM +	1.76	1.78	1.80	0%	NONE	Population
PHILADELPHIA	Miscellaneous Area Sources	STRUCTURE FIRES	0.12	0.12	0.12	0%	NONE	None
PHILADELPHIA	Transportation	RAILROADS	5.73	5.50	5.29	0%	NONE	Railroad Emp
PHILADELPHIA	Transportation	AIRCRAFT	6.83	7.09	7.30	0%	NONE	Air Trans Emp
PHILADELPHIA	Waste Disposal, Treatment &	OPEN BURNING	0.02	0.02	0.02	0%	NONE	Population
PHILADELPHIA	Waste Disposal, Treatment &	SOLID WASTE INCINERATION	0.60	0.61	0.61	0%	NONE	Population
PHILADELPHIA Total			22.71	22.83	22.93			
Grand Total			47.01	47.10	47.16			

Area Source VOC Emissions

County	Category	emis99	emis02	emis05	96 CE	99 CE	02 CE	05 CE	con99	con02	con05	Control Type	Growth Key
BUCKS	COAL COMBUSTION	0.00	0.00	0.00	0%	0%	0%	0%	0.00	0.00	0.00	NONE	Population
BUCKS	FUEL OIL COMBUSTION (COMM +	0.07	0.07	0.07	0%	0%	0%	0%	0.07	0.07	0 07	NONE	Population
BUCKS	NATURAL GAS & LPG	0.04	0 04	0 04	0%	0%	0%	0%	0 04	0.04	0.04	NONE	Population
BUCKS	ASPHALT	0.29	0.29	0.29	0%	0%	0%	0%	0.29	0.29	0.29	NONE	Population
BUCKS	COMMERCIAL/CONSUMER	4.82	4.87	4.91	20%	20%	20%	20%	3.86	3.89	3.93	CONSUMER PROD	Population
BUCKS	PESTICIDES	0 37	0.37	0 38	0%	0%	0%	0%	0.37	0.37	0.38	NONE	Population
BUCKS	BIOPROCESSES	0.29	0.29	0.30	0%	0%	0%	0%	0.29	0.29	0.30	NONE	Population
BUCKS	FOREST FIRES	0.00	0.00	0 00	0%	0%	0%	0%	0.00	0.00	0 00	NONE	None
BUCKS	STRUCTURE FIRES	0.33	0.33	0.33	0%	0%	0%	0%	0.33	0.33	0.33	NONE	None
BUCKS	ARCHITECTURAL SURFACE	4.57	4.62	4.66	20%	20%	20%	20%	3.66	3.69	3.73	AIM COATINGS	Population
BUCKS	AUTO REFINISHING	3.07	3.10	3.13	35%	35%	35%	35%	2.00	2.02	2.04	AUTOBODY	Population
BUCKS	DEGREASING ALL	3.55	3.51	3.47	0%	0%	0%	0%	3.55	3.51	3.47	NONE	Durable Mfg Emp
BUCKS	DRY CLEANING	0.11	0.12	0.12	0%	0%	0%	0%	0.11	0.12	0.12	NONE	Population
BUCKS	ELECTRICAL INSULATION	0.02	0.02	0.02	0%	0%	0%	0%	0.02	0.02	0.02	NONE	Durable Mfg Emp
BUCKS	FACTORY FINISHED WOOD	0.13	0.13	0.13	0%	0%	0%	0%	0.13	0.13	0.13	NONE	Durable Mfg Emp
BUCKS	HIGH PERFORMANCE INDUSTRIAL	0.57	0.56	0.56	20%	20%	20%	20%	0.45	0.45	0 44	AIM COATINGS	Durable Mfg Emp
BUCKS	MACHINERY & EQUIP	0.63	0.61	0.60	0%	0%	0%	0%	0 63	0.61	0.60	NONE	Electric Mach Emp
BUCKS	METAL CANS	1.48	1.48	1.47	0%	0%	0%	0%	1.48	1.48	1.47	NONE	Fabricated Metals Em
BUCKS	MISC FINISHED METALS	0.30	0.30	0.30	0%	0%	0%	0%	0.30	0.30	0.30	NONE	Fabricated Metals Em
BUCKS	MISC MANUFACTURING	0.43	0.42	0 42	0%	0%	0%	0%	0 43	0.42	0.42	NONE	Durable Mfg Emp
BUCKS	OTHER TRANSPORTATION	0.03	0.03	0.03	0%	0%	0%	0%	0.03	0.03	0.03	NONE	Transportation Emp
BUCKS	TRAFFIC LINE PAINTING	0.38	0 39	0.39	0%	0%	0%	0%	0.38	0.39	0 39	NONE	Population
BUCKS	WOOD FURNITURE	1.14	1.16	1.18	0%	0%	0%	0%	1.14	1.16	1.18	NONE	Furniture Emp
BUCKS	GASOLINE MARKETING STAGE 1	0.95	0.98	1.01	0%	0%	0%	0%	0.95	0.98	1.01	NONE	VMT
BUCKS	GASOLINE MARKETING STAGE II	4.43	4.57	4.71	78%	79%	86%	90%	0.91	0.63	0.49	STAGE II VAPOR	VMT
BUCKS	TANK BREATH	0.38	0.39	0.40	0%	0%	0%	0%	0.38	0 39	0.40	NONE	VMT
BUCKS	TANK TRANSIT	0.04	0.04	0.04	0%	0%	0%	0%	0.04	0.04	0.04	NONE	VMT
BUCKS	AIRCRAFT	0.03	0.03	0.04	0%	0%	0%	0%	0.03	0.03	0.04	NONE	Air Trans Emp
BUCKS	AIRCRAFT REFUELING	0.01	0.01	0.01	0%	0%	0%	0%	0.01	0.01	0 01	NONE	Air Trans Emp
BUCKS	RAILROADS	0 16	0.15	0.15	0%	0%	0%	0%	0.16	0.15	0 15	NONE	Railroad Emp
BUCKS	LANDFILLS	0.12	0.12	0.12	0%	0%	0%	0%	0.12	0.12	0.12	NONE	Population
BUCKS	OPEN BURNING	0.04	0.04	0.04	0%	0%	0%	0%	0.04	0.04	0.04	NONE	Population
BUCKS	POTWs	0.42	0.42	0 43	0%	0%	0%	0%	0.42	0.42	0.43	NONE	Population
BUCKS	SOLID WASTE INCINERATION	0.25	0.25	0.25	0%	0%	0%	0%	0.25	0.25	0.25	NONE	Population
BUCKS	TSDFs	0.06	0.06	0.06	75%	75%	75%	75%	0.01	0.01	0 01	TSDF	Population
BUCKS Total		29.52	29.79	30.05					22 89	22.71	22 66		

Area Source VOC Emissions

County	Category	emis99	emis02	emis05	96 CE	99 CE	02 CE	05 CE	con99	con02	con05	Control Type	Growth Key
DELAWARE	COAL COMBUSTION	0.00	0.00	0.00	0%	0%	0%	0%	0.00	0.00	0.00	NONE	Population
DELAWARE	FUEL OIL COMBUSTION (COMM +	0.05	0.05	0.05	0%	0%	0%	0%	0.05	0.05	0.05	NONE	Population
DELAWARE	NATURAL GAS & LPG	0.09	0 09	0.09	0%	0%	0%	0%	0.09	0.09	0.09	NONE	Population
DELAWARE	ASPHALT	0.29	0 29	0.30	0%	0%	0%	0%	0.29	0.29	0.30	NONE	Population
DELAWARE	COMMERCIAL/CONSUMER	4.88	4.92	4.97	20%	20%	20%	20%	3.90	3.94	3 98	CONSUMER PROD	Population
DELAWARE	PESTICIDES	0.02	0.02	0.02	0%	0%	0%	0%	0.02	0.02	0.02	NONE	Population
DELAWARE	BIOPROCESSES	0.30	0.31	0.31	0%	0%	0%	0%	0.30	0.31	0 31	NONE	Population
DELAWARE	STRUCTURE FIRES	0.34	0.34	0.34	0%	0%	0%	0%	0 34	0.34	0.34	NONE	None
DELAWARE	ARCHITECTURAL SURFACE	4.63	4.67	4.72	20%	20%	20%	20%	3.70	3.74	3.78	AIM COATINGS	Population
DELAWARE	AUTO REFINISHING	2.81	2.84	2.86	35%	35%	35%	35%	1.83	1.84	1.86	AUTOBODY	Population
DELAWARE	DEGREASING ALL	2.02	2.00	1 98	0%	0%	0%	0%	2.02	2.00	1.98	NONE	Durable Mfg Emp
DELAWARE	DRY CLEANING	0.12	0.12	0.12	0%	0%	0%	0%	0.12	0.12	0.12	NONE	Population
DELAWARE	FACTORY FINISHED WOOD	0.03	0.03	0.03	0%	0%	0%	0%	0.03	0.03	0.03	NONE	Durable Mfg Emp
DELAWARE	HIGH PERFORMANCE INDUSTRIAL	0.58	0.57	0.56	20%	20%	20%	20%	0.46	0.46	0.45	AIM COATINGS	Durable Mfg Emp
DELAWARE	MACHINERY & EQUIP	0.15	0.14	0.14	0%	0%	0%	0%	0.15	0.14	0.14	NONE	Electric Mach Emp
DELAWARE	MARINE SOLVENTS	0.30	0.30	0.30	20%	20%	20%	20%	0.24	0.24	0.24	AIM COATINGS	Durable Mfg Emp
DELAWARE	METAL FURNITURE AND FIXTURES	0.62	0.63	0.64	0%	0%	0%	0%	0.62	0.63	0.64	NONE	Furniture Emp
DELAWARE	MISC FINISHED METALS	0.06	0.06	0.06	0%	0%	0%	0%	0.06	0.06	0.06	NONE	Fabricated Metals Em
DELAWARE	MISC MANUFACTURING	0.43	0.43	0.42	0%	0%	0%	0%	0.43	0.43	0.42	NONE	Durable Mfg Emp
DELAWARE	TRAFFIC LINE PAINTING	0.39	0.39	0.39	0%	0%	0%	0%	0.39	0.39	0.39	NONE	Population
DELAWARE	GASOLINE MARKETING STAGE 1	0.61	0.63	0.65	0%	0%	0%	0%	0.61	0.63	0.65	NONE	VMT
DELAWARE	GASOLINE MARKETING STAGE II	2.86	2.95	3.04	78%	79%	86%	90%	0.59	0.41	0.31	STAGE II VAPOR	VMT
DELAWARE	TANK BREATH	0.24	0.25	0.26	0%	0%	0%	0%	0.24	0.25	0.26	NONE	VMT
DELAWARE	TANK TRANSIT	0.03	0.03	0.03	0%	0%	0%	0%	0.03	0.03	0.03	NONE	VMT
DELAWARE	AIRCRAFT	5.87	6.09	6.27	0%	0%	0%	0%	5.87	6.09	6.27	NONE	Air Trans Emp
DELAWARE	AIRCRAFT REFUELING	0.02	0.02	0.02	0%	0%	0%	0%	0.02	0.02	0.02	NONE	Air Trans Emp
DELAWARE	RAILROADS	0.19	0.19	0.18	0%	0%	0%	0%	0.19	0.19	0.18	NONE	Railroad Emp
DELAWARE	OPEN BURNING	0.01	0.01	0.01	0%	0%	0%	0%	0.01	0.01	0.01	NONE	Population
DELAWARE	POTWs	0.54	0.55	0.55	0%	0%	0%	0%	0.54	0.55	0.55	NONE	Population
DELAWARE	SOLID WASTE INCINERATION	0.22	0.22	0.22	0%	0%	0%	0%	0.22	0.22	0.22	NONE	Population
DELAWARE	TSDFs	0.32	0.32	0 33	75%	75%	75%	75%	0.08	0.08	0.08	TSDF	Population
DELAWARE Total		29.01	29.46	29.86					23.44	23.59	23.78		

Area Source VOC Emissions

County	Category	emis99	emis02	emis05	96 CE	99 CE	02 CE	05 CE	con99	con02	con05	Control Type	Growth Key
PHILADELPHIA	COAL COMBUSTION	0 00	0.00	0.00	0%	0%	0%	0%	0.00	0.00	0.00	NONE	Population
PHILADELPHIA	FUEL OIL COMBUSTION (COMM +	0.06	0.06	0.06	0%	0%	0%	0%	0.06	0.06	0.06	NONE	Population
PHILADELPHIA	NATURAL GAS & LPG	0.38	0.39	0.39	0%	0%	0%	0%	0.38	0 39	0 39	NONE	Population
PHILADELPHIA	ASPHALT	0.84	0.85	0.85	0%	0%	0%	0%	0.84	0.85	0.85	NONE	Population
PHILADELPHIA	COMMERCIAL/CONSUMER	14.12	14.26	14.39	20%	20%	20%	20%	11.29	11.40	11.52	CONSUMER PROD	Population
PHILADELPHIA	STRUCTURE FIRES	0.97	0.97	0.97	0%	0%	0%	0%	0.97	0.97	0.97	NONE	None
PHILADELPHIA	ARCHITECTURAL SURFACE	13.40	13.53	13.66	20%	20%	20%	20%	10.72	10.83	10.93	AIM COATINGS	Population
PHILADELPHIA	AUTO REFINISHING	4.85	4.90	4.95	35%	35%	35%	35%	3.15	3.19	3.22	AUTOBODY	Population
PHILADELPHIA	DEGREASING ALL	2.97	2.94	2.91	0%	0%	0%	0%	2 97	2.94	2.91	NONE	Durable Mfg Emp
PHILADELPHIA	DRY CLEANING	0.09	0.10	0.10	0%	0%	0%	0%	0.09	0.10	0.10	NONE	Population
PHILADELPHIA	ELECTRICAL INSULATION	0.14	0.14	0.14	0%	0%	0%	0%	0.14	0.14	0.14	NONE	Durable Mfg Emp
PHILADELPHIA	FACTORY FINISHED WOOD	0.10	0.10	0.10	0%	0%	0%	0%	0.10	0.10	0.10	NONE	Durable Mfg Emp
PHILADELPHIA	GRAPHIC ARTS	2.56	2.60	2.64	0%	0%	0%	0%	2.56	2.60	2.64	NONE	Printing Emp
PHILADELPHIA	HIGH PERFORMANCE INDUSTRIAL	1.67	1.65	1.63	20%	20%	20%	20%	1.33	1.32	1.30	AIM COATINGS	Durable Mfg Emp
PHILADELPHIA	MACHINERY & EQUIP	0.42	0.40	0.39	0%	0%	0%	0%	0.42	0.40	0.39	NONE	Electric Mach Emp
PHILADELPHIA	MARINE SOLVENTS	0.02	0.02	0.02	20%	20%	20%	20%	0.02	0.02	0.02	AIM COATINGS	Durable Mfg Emp
PHILADELPHIA	METAL CANS	5.04	5.03	5.00	0%	0%	0%	0%	5.04	5.03	5.00	NONE	Fabricated Metals Em
PHILADELPHIA	METAL FURNITURE AND FIXTURES	0.92	0.94	0.96	0%	0%	0%	0%	0.92	0.94	0.96	NONE	Furniture Emp
PHILADELPHIA	MISC MANUFACTURING	1.25	1.24	1.22	0%	0%	0%	0%	1.25	1.24	1.22	NONE	Durable Mfg Emp
PHILADELPHIA	OTHER TRANSPORTATION	0.15	0.16	0.16	0%	0%	0%	0%	0 15	0.16	0.16	NONE	Transportation Emp
PHILADELPHIA	TRAFFIC LINE PAINTING	1.12	1.13	1.14	0%	0%	0%	0%	1.12	1.13	1.14	NONE	Population
PHILADELPHIA	WOOD FURNITURE	1.33	1.36	1.38	0%	0%	0%	0%	1.33	1.36	1.38	NONE	Furniture Emp
PHILADELPHIA	GASOLINE MARKETING STAGE 1	1.22	1.26	1.29	0%	0%	0%	0%	1.22	1.26	1.29	NONE	VMT
PHILADELPHIA	GASOLINE MARKETING STAGE II	5.69	5.87	6.05	78%	79%	86%	90%	1.17	0.81	0.63	STAGE II VAPOR	VMT
PHILADELPHIA	TANK BREATH	0.49	0.50	0.52	0%	0%	0%	0%	0.49	0.50	0.52	NONE	VMT
PHILADELPHIA	TANK TRANSIT	0.05	0.05	0.06	0%	0%	0%	0%	0.05	0.06	0.06	NONE	VMT
PHILADELPHIA	AIRCRAFT	1.42	1.47	1.51	0%	0%	0%	0%	1.42	1.47	1.51	NONE	Air Trans Emp
PHILADELPHIA	AIRCRAFT REFUELING	0.01	0.01	0.01	0%	0%	0%	0%	0.01	0.01	0.01	NONE	Air Trans Emp
PHILADELPHIA	RAILROADS	0.41	0.39	0.38	0%	0%	0%	0%	0.41	0.39	0.38	NONE	Railroad Emp
PHILADELPHIA	OPEN BURNING	0.08	0.08	0.08	0%	0%	0%	0%	0.08	0.08	0.08	NONE	Population
PHILADELPHIA	POTWs	5.95	6.01	6.06	0%	0%	0%	0%	5.95	6.01	6.06	NONE	Population
PHILADELPHIA	SOLID WASTE INCINERATION	0.60	0.61	0 61	0%	0%	0%	0%	0.60	0 61	0.61	NONE	Population
PHILADELPHIA	TSDFs	2.88	2.91	2.94	75%	75%	75%	75%	0.72	0 73	0 73	TSDF	Population
PHILADELPHIA Total		71.21	71.91	72.58					56.99	57.08	57.28		
Grand Total		202.86	205.11	207.23					155.65	155 52	155.95		

Appendix III

H. Highway Vehicle Modeling Documentation

MOBILE SOURCE EMISSIONS METHODOLOGY

VMT and Speed Modeling Methodology

The following summarizes some of the most pertinent aspects of the modeling procedure. Detailed documentation of the inventory and forecast runs are being prepared in anticipation of the formal submission to the EPA.

MOBILE5a_H was used for calculating emissions factors. It was supported by the Post Processor for Air Quality (PPAQ), a set of programs which analyzes network operating conditions, calculates highway segment speeds, compiles VMT and vehicle type mix data, prepares the MOBILE runs, and calculates emissions quantities from the emissions rates and VMT.

Source of VMT

The Roadway Management System (RMS) is maintained by PennDOT's Bureau of Transportation System Performance (BTPS). It contains for each state highway segment plus the Pennsylvania Turnpike 1992 and current traffic counts and truck percentages, and a variety of physical attributes of the segment. This data was extracted from RMS and compiled into a database for emissions calculation purposes.

Adjustment factors were calculated which adjust the 1992 RMS VMT to be consistent with HPMS totals, by county, urban/small urban/rural area, and functional class. Adjustments for the "higher" functional classes were very close to 1.000, since HPMS VMT is derived from RMS. "Lower" classes (i.e. local) required greater adjustment, since a large part of the local system is not under state jurisdiction and is not in the RMS database. The state highway system does, however, contain a significant amount of local mileage; it was assumed that these local streets are representative of the local streets in their area with respect to volume and speed, so that a roadway mileage adjustment was appropriate.

Seasonal and daily adjustment factors have been developed by BTSP for traffic pattern regions and functional classes. These were applied to the 1990 AADT volumes to produce July, 1990, average weekday traffic (AWDT) volumes on each segment. This adjusted volume then was the basis for the inventory and forecast runs.

Aggregation Scheme

While highway volumes, vehicle mixes, and speeds are calculated on the basis of individual highway segment and hour, this data is far too disaggregate to apply directly to MOBILE. Instead, VMT and Vehicle Hours of Travel (VHT) are accumulated by larger geographic areas, highway functional class, and time period. Geographic aggregation was performed by urban, small urban, and rural areas of each county. Functional class aggregation was according to PennDOT's eighteen standard functional classes, respecting urban, small urban , and rural definitions. Time period aggregation was according to am peak (6-9 am), pm peak (4-7 pm), midday (9 am - 4 pm), and night (7 pm - 6 am). For an individual county this creates a potential for 72 possible combinations , each of which becomes a MOBILE scenario. This allows each MOBILE scenario to represent the actual VMT mix, speed, and (potentially) cold / hot start fraction for that geographic / highway / time combination.

Vehicle Type Mix

The RMS database contains daily truck percentages on each highway segment, estimated from traffic counts. Additional pattern data assembled by BTSP was applied to generate the hourly distribution of trucks for different functional classes, plus the MOBILE default type distribution was used to split the generic "trucks" category to the MOBILE sub-vehicle types. For each link, then, PPAQ calculates an hourly vehicle mix as a percentage of the hourly volume.

The truck percentage is used to adjust highway capacity for speed estimation, as discussed below.

As VMT is accumulated to the geographic area / functional class / time period table, it is actually stratified by vehicle type. After all highway segments have been processed, then, total and vehicle-type VMT have been accumulated for each of the MOBILE scenarios. Simple division then calculates the vehicle mix that is input to MOBILE as part of each scenario's specification.

Cold / Hot Start Fractions

MOBILE default cold and hot start fractions of 20.6 and 27.3 percent are used in all scenarios.

Speed Estimation

Physical attributes of each highway segment are contained in the database. These include functional class, number of lanes, and urban / small urban / rural setting. Using this information the zero-volume speed and capacity of the segment are estimated. Truck percentage adjustments are then applied to produce an adjusted hourly capacity.

For functional classes which do not have control devices (i.e. freeways, expressways, and rural highways) a modified BPR formula with adjusted coefficients is used to calculate the speeds that will occur for each hour on the segment. This speed reflects the traffic volume, vehicle mix, and physical segment characteristics.

For functional classes which do have control devices (i.e. urban arterials), an intersection approach model is used to simulate the effect of traffic signals on speed. For each type of facility (differentiated by functional class, number of lanes, and urban / small urban / rural setting), key parameters such as average signal spacing, cycle length, green time, additional approach lanes, and progression factor are extracted from a lookup table. Using 1985 Highway Capacity Manual delay equations, the effect of traffic volume on traffic-signal delay is calculated, and added to the link travel time calculated above.

The result of this process is, for each highway segment, an estimated average travel time and speed for each hour of the day. The average time is multiplied by volume to produce vehicle hours of travel (VHT). VHT is then accumulated for each of the above MOBILE scenarios, and when complete an average speed for the scenario is calculated by dividing VMT by VHT. This, then, is the speed which is input to MOBILE.

Time of Day and Diurnal Emissions

The highway system VMT and speeds are aggregated according to four time periods. Because diurnal emissions are calculated by MOBILE on the basis of 24-hour minimum-to-maximum temperatures, special processing is needed to accurately estimate the emissions component by allocating daily diurnal emissions to the various time periods. In order to use this method, minimum and maximum temperatures are required for each of the four time periods, in addition to the daily minimum and maximum temperatures. MOBILE5a_H is then run at all five temperature ranges, as outlined in the example below:

		Daily Min	Daily Max
Run 1	24-hour	70	93
		Starting Temp.	Ending Temp.
Run 2	A.M. Peak	70	77
Run 3	Midday	77	93
Run 4	P.M. Peak	93	75
Run 5	Night	75	70

Run 1 is made in order to calculate the daily diurnal emissions. Diurnal emissions are given in grams/vehicle/day in the expanded evaporative emissions section of the MOBILE5a_H output file. The diurnal emissions value can be converted into a grams/mile emissions factor by dividing it by the MOBILE5a_H default daily mileage for each vehicle type:

$$EF_d = E_d / MV$$

EF_d = diurnal HC emissions factor (grams/mile)
E_d = daily diurnal HC emissions (grams/vehicle)
MV = MOBILE5a_H default daily mileage (miles/vehicle)

MOBILE5a_H Default Average Daily Vehicle Mileage

Vehicle Type	Average Daily Mileage (mile/day)
LDGV	31.1
LDGT1	26.3
LDGT2	33.7
HDGV	36.7
LDDV	31.1
LDDT	29.8
HDDV	138.3
MC	8.3

Diurnal emission factors must be calculated in the same manner for Runs 2 through 5, and the diurnal emission factors must be subtracted from the total HC emission factor as shown below. This is necessary because the diurnal emission factor generated by the model for each of these time periods represents diurnal emissions for the entire day.

$$EF_n = EF_t - EF_d$$

EF_n = HC emission factor (no diurnal emissions) (grams/mile)
EF_t = total HC emissions factor (grams/mile)
EF_d = diurnal HC emissions factor (grams/mile)

For time periods in which the ending temperature is lower than the starting temperature, diurnal emissions are assumed to be zero and Ef_n can be used as the actual emissions factor for that time period. This would include the p.m. peak and nighttime periods in the previous example.

For time periods in which ending temperature is higher than starting temperature, the actual HC can be calculated in the following manner:

$$EF_A = EF_N + (EF_D * (DT_p / DT_d))$$

EF_A = actual HC emissions factor (grams/mile)
EF_N = HC emissions factor (no diurnal emissions) (grams/mile)
DT_p = increase in temperature over the current time period (degrees)
DT_d = max daily temperature - min daily temperature

This formula adds in a fraction of the daily diurnal emission factor, depending on the fraction of the daily temperature increase that takes place during the current time period.

The adjustment process is performed automatically by PPAQ if more than one time period is specified.

Phase II - Reformulated Gasoline Methodology

The reformulate gasoline (RFG) Phase II NOx credit, starting in calendar year 2000, can only be quantified using MOBILE5b version of the MOBILE model. MOBILE5a_H will only show a VOC credit for RFG. For areas that require RFG, an additional modeling scenario is performed to account for the additional NOx reductions using MOBILE5b and PPAQ. The following methodology is used:

For Analysis Years > 2000

Run 1: Final PA control strategy (includes I/M program, FMVCP and RFG)

Run 2: Final PA control strategy minus RFG

RFG Phase II NOx credit = Run 1 – Run 2

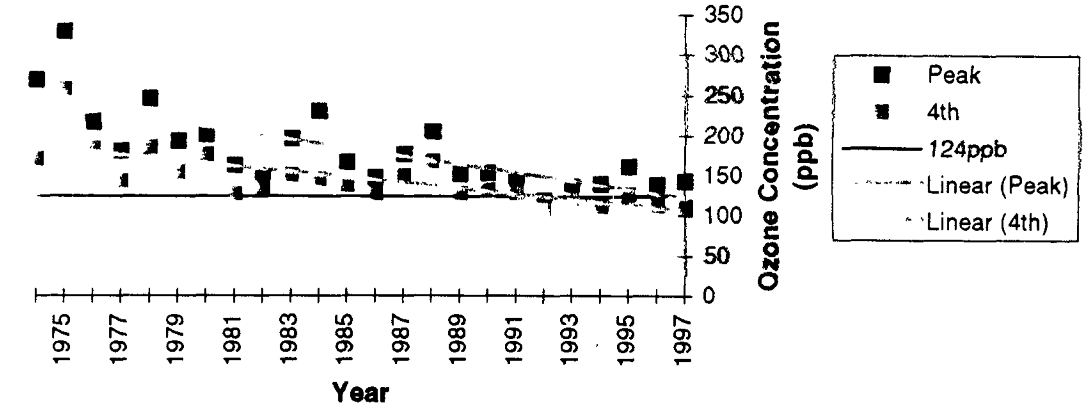
The calculated RFG Phase II NOx credit is then subtracted from the NOx totals of the Final PA control strategy scenario to estimate the overall emissions for the modeled area.

Appendix IV: Monitoring Information

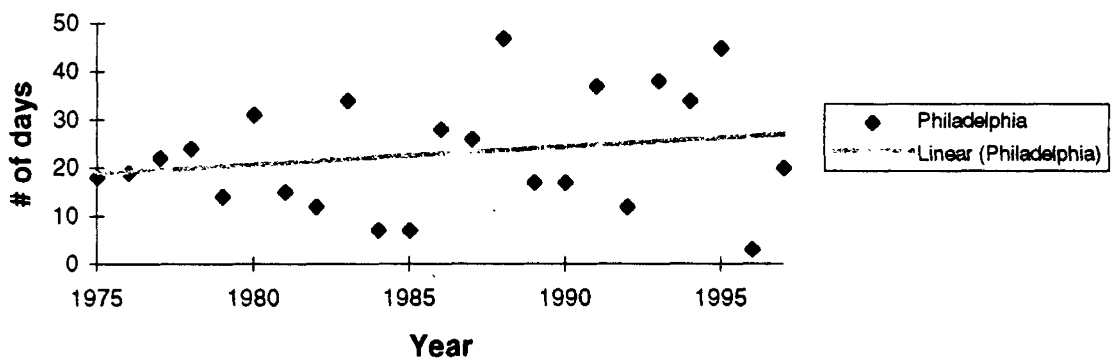
Appendix 4

List of Charts

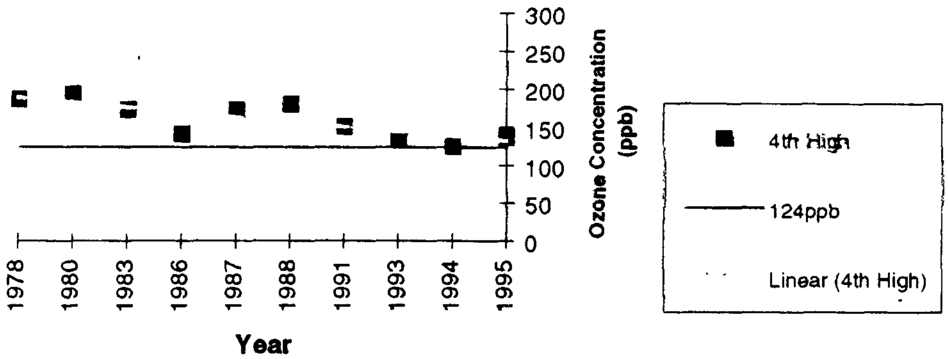
Bristol, PA 1974-97



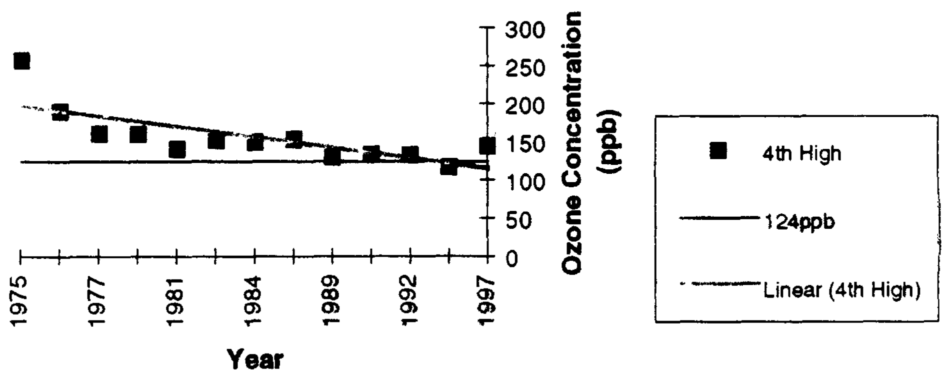
Number of Days >= 90 Degrees (JJA), Philadelphia International Airport

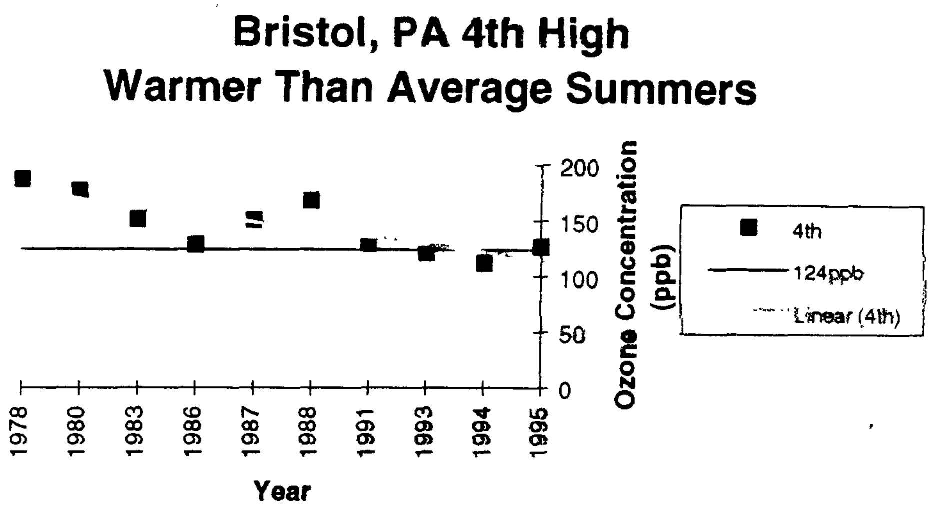


Philadelphia Max 4th High
Warmer Than Average Summers

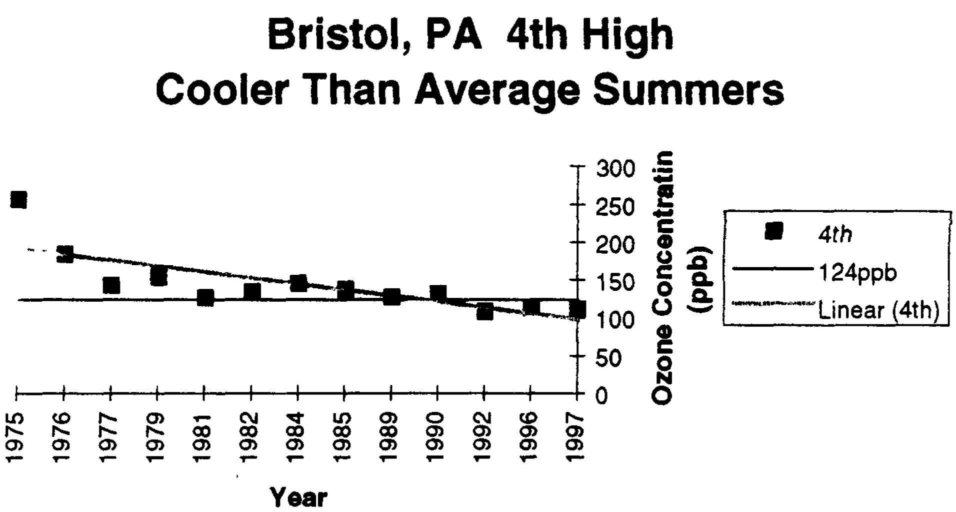


Philadelphia Max 4th High
Cooler Than Average Summers



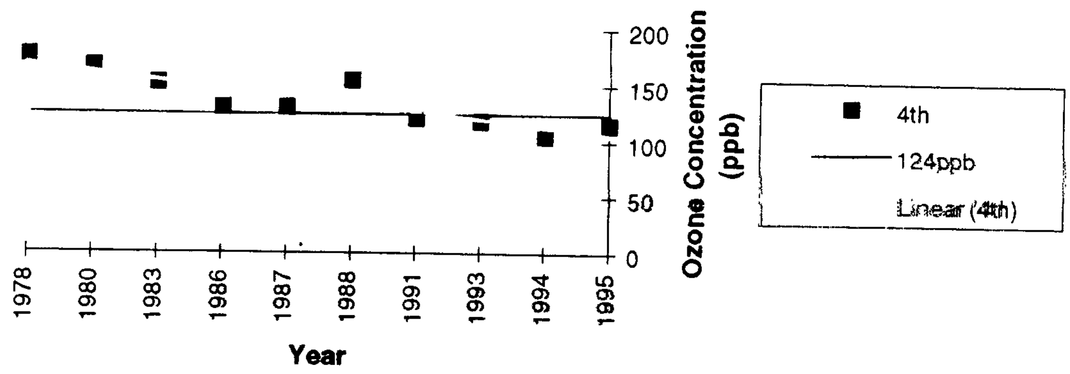


Bristol, PA 4th High
Warmer Than Average Summers
200
150
100
50
0
Ozone Concentration (ppb)
4th
124ppb
Linear (4th)
1978
1980
1983
1986
1987
1988
1991
1993
1994
1995
Year

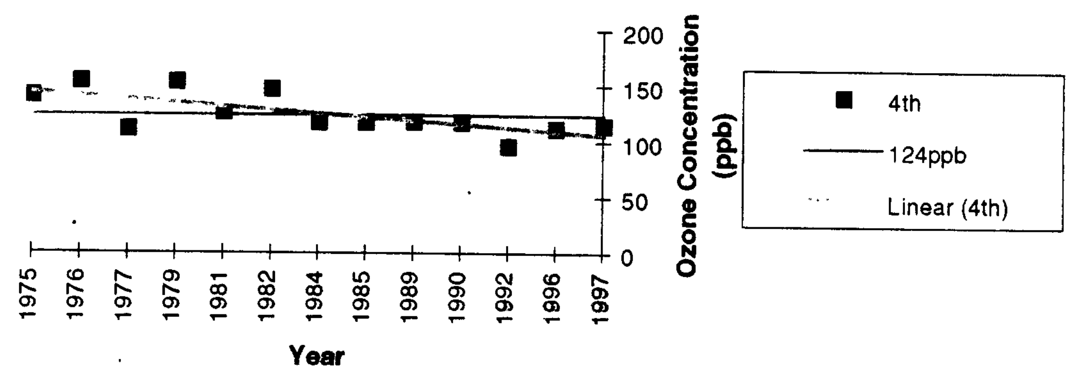


Bristol, PA 4th High
Cooler Than Average Summers
300
250
200
150
100
50
0
Ozone Concentratin (ppb)
4th
124ppb
Linear (4th)
1975
1976
1977
1979
1981
1982
1984
1985
1989
1990
1992
1996
1997
Year

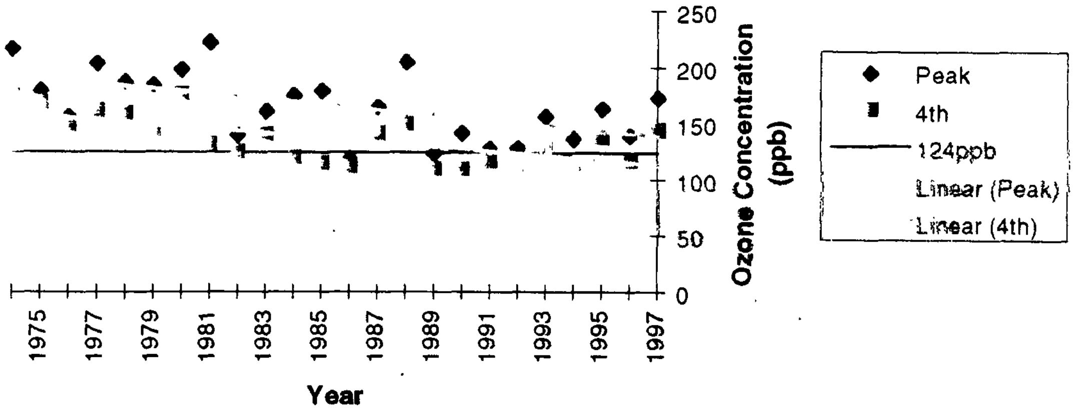
Chester, PA 4th High
Warmer Than Normal Summers



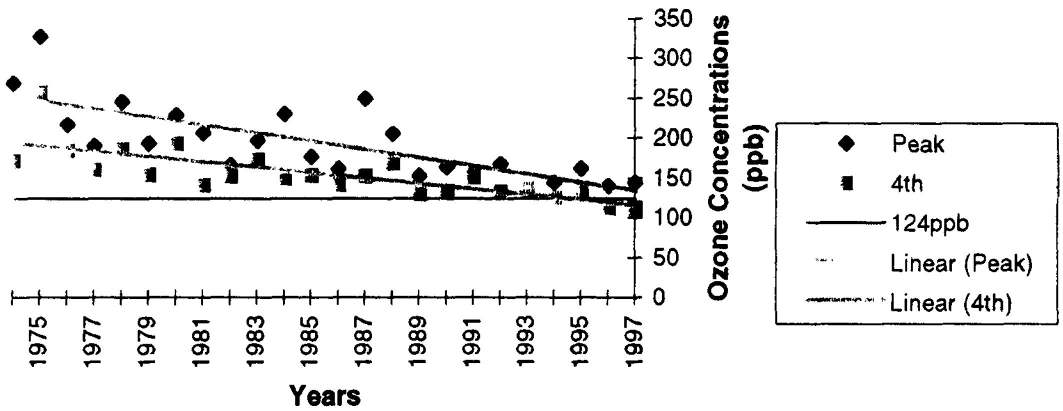
Chester, PA 4th High
Cooler Than Normal Years



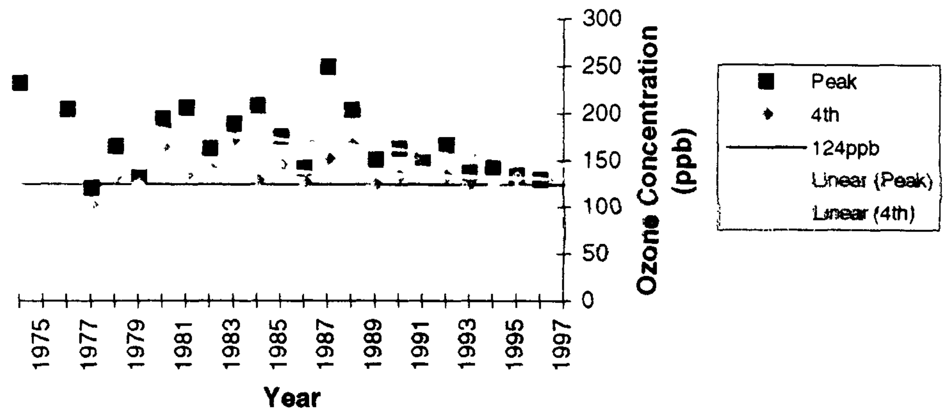
Upwind Sites, 1974-97



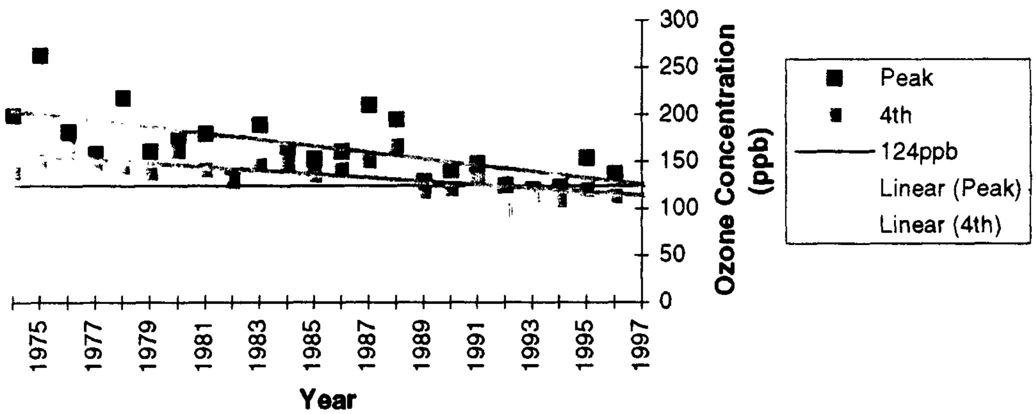
Downwind Sites, 1974-97



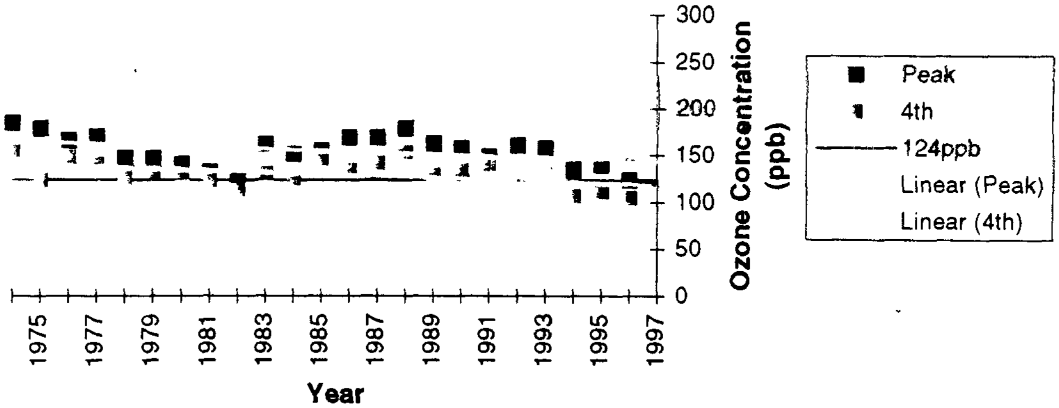
Mercer County, NJ 1974-97



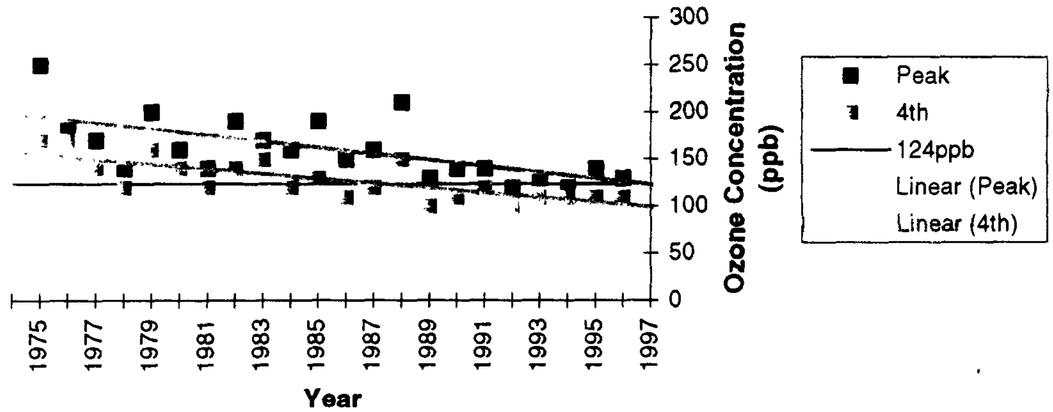
Camden, NJ 1974-97



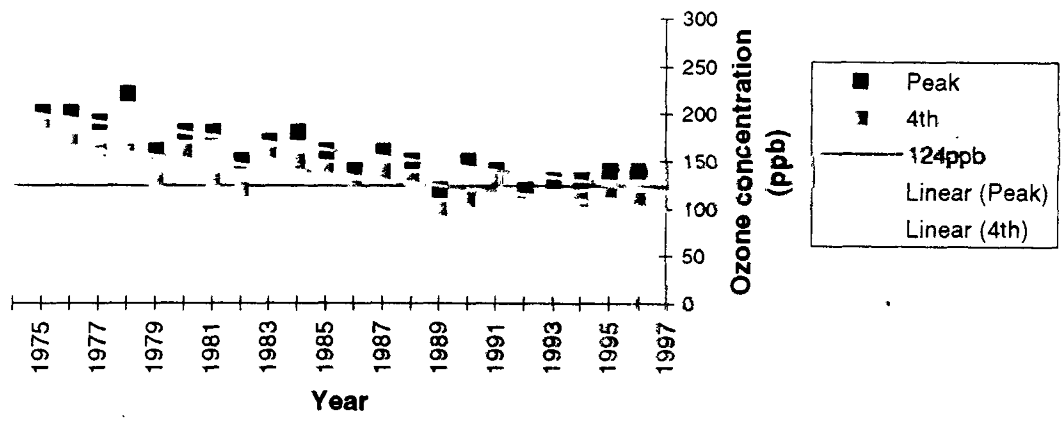
Ancora State Hospital, NJ 1974-97



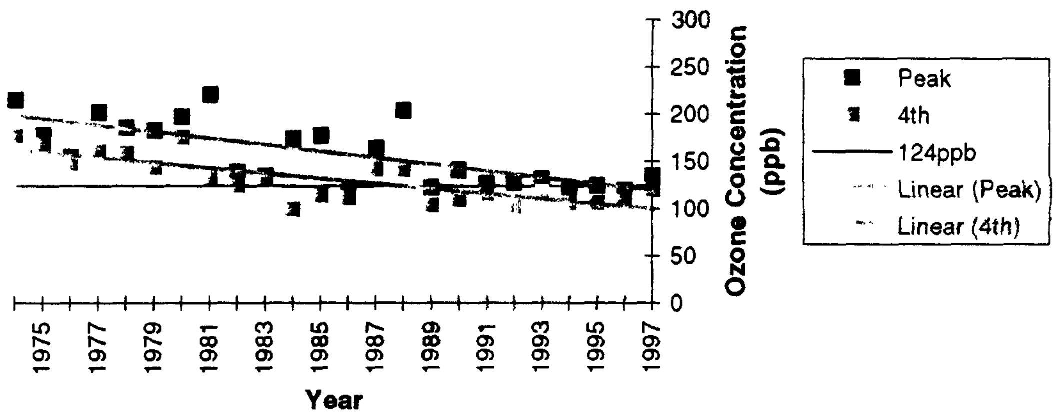
Roxborough, PA 1974-97



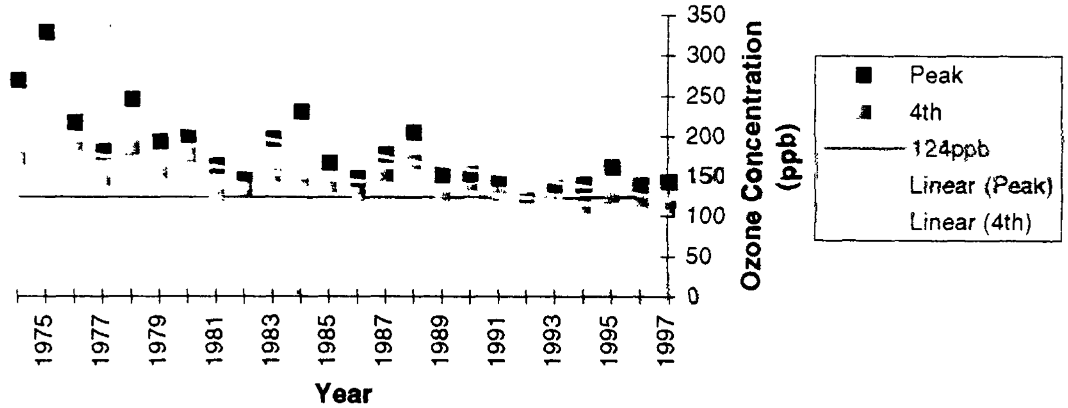
N/E Philadelphia, PA 1974-97



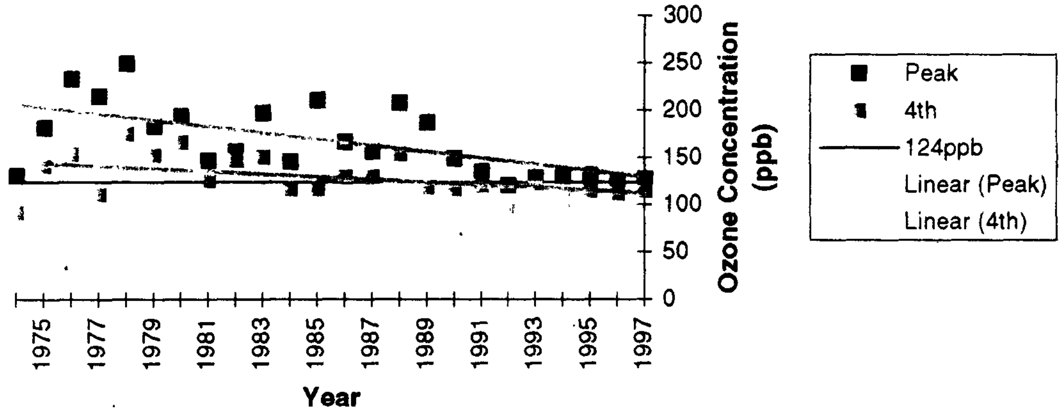
Norristown, PA 1974-97



Bristol, PA 1974-97



Chester, PA 1974-97



Appendix V: Modeling Information

MOBILE Modeling and Air Quality Modeling Appendices Under Separate Cover
(1 copy each -- additional copies available from us upon your request)

COMMENT/RESPONSE DOCUMENT

SIP Revision for the Philadelphia Interstate Ozone Nonattainment Area: Phase II Plan Proposed January 31, 1998

COMMENTATORS

1. James O'Brien
   Lukens Inc.
   50 South First Avenue
   Coatesville, PA 19320

2. Robert Warland, Director
   Division of Air Resources
   New York State Department of Environmental Conservation
   50 Wolf Road
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3. Jason Rash, Esq.
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4. Judith Katz
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   841 Chestnut Building
   Philadelphia, PA 19107-4431

Numbers in parentheses after each comment refer to the commentator as listed above.

***COMMENT 1:** The Commentator has reviewed the Phase II plan and has determined that no 1990 emissions are listed for the Lukens' Conshohocken facility in Montgomery County. The Commentator requests that this facility be included in the inventory. (1)*

RESPONSE: The Department agrees that the Lukens facility was omitted from the tables and the 1990 VOC inventory. Since the Phase I plan which will be submitted to EPA later in 1998, will include the 1990 NOx baseline inventory for SIP approval, Lukens' NOx emissions will be part of that submission. The Phase I plan will also request a SIP amendment to add these emission to the 1990 VOC baseline inventory. The Department records show that Lukens' Conshohocken plant emitted 15.6 tons of VOC and 158.6 tons of NOx in 1990. The VOC emissions equal approximately 0.04 tons per typical summer day. This value is very low and will not affect the projected inventories, including the 15% plan.

COMMENT 2: The commentator supports Pennsylvania's call for EPA to enact controls on certain large sources of NOx. (2)

RESPONSE: The Commonwealth appreciates the support.

COMMENT 3: The Plan does not state, or even suggest, that it contains the programs necessary to bring the Philadelphia area into attainment. (3)

RESPONSE: We believe that data presented reasonably demonstrates that with noted local reductions and reduction of transported pollutants, the area will attain the one-hour ozone standard. Current data and predictive capabilities are significantly limited.

COMMENT 4: The Council opposes any proposal by Pennsylvania to exempt other parts of the Commonwealth from vehicle emission inspection/maintenance requirements because mobile emissions from counties upwind of the Greater Philadelphia area contribute to the region's chronic ozone problems. (3)

RESPONSE: We understand the Council's position. This SIP revision does not take any action which exempts other parts of the Commonwealth from I/M because it addresses only the five-county Philadelphia area itself.

COMMENT 5: The plan should contain a more thorough narrative description of mobile source methodologies, such as how information was generated by the model and the source of the underlying data. This documentation, in addition to the detailed summaries of numerical results, will greatly help in reviewing of the plan. (3, 4) The presentation of the mobile source data is difficult to understand., Because of this, the commentator has concerns that emission reduction credits are illusory. (3)

RESPONSE: Much of the methodology has been presented in past SIP revisions and was referred to in this plan. Pennsylvania uses a computer model to process transportation data. While this contributes to accuracy, it undoubtedly makes it more difficult for readers to understand how reductions were calculated. DEP provides considerable documentation in Appendix III, including numerous summary tables, vehicle emission inspection/maintenance program inputs, sample input and output files. To address the comments in the short term, a short description of methodology has been added to Appendix III. In addition, a section on transportation conformity in the plan has been added which provides additional mobile source information. DEP will also work with EPA to improve its narrative presentation of this information for the Phase I plan to be submitted in late summer 1998 as well as any future submissions involving MOBILE modeling.

COMMENT 6: The commentator stated that the Commonwealth is behind on its RACT submittals to EPA and that EPA is behind on its approvals of the submittals. The commentator stated that this problem is particularly apparent in regard to utilities. (3, 4)

RESPONSE: The Department has completed work on the major NOx sources in Pennsylvania. In general, these sources have demonstrated a forty (40) percent emission reduction in NOx emissions from 1990 levels. The remaining RACT applications deal with small sources whose RACT requirement is equipment maintenance. No significant emission reductions are anticipated from these small sources. All sources with completed RACT reviews are required to have demonstrated compliance with the RACT limitations regardless of EPA action. The Department has submitted the completed RACT permits to EPA as revisions to the State Implementation Plan. The commentator is correct that EPA has not completed work on reviewing these SIP revisions. The Department anticipates EPA action to continue for a significant amount of time. However, this lack of EPA action will not impact the emission reductions being achieved by the sources.

The fact that EPA has not acted on most of the RACT SIP submittals does not mean that the emission reductions, which RACT is designed to achieve, have not occurred. Most of the planned emission reductions were secured by May 1995 with some delayed until May 1996. Nevertheless, the Department shares the concern that the plans have not been formally approved and incorporated into the SIP since it does create an unacceptable level of uncertainty for affected facilities, the Department, and the public.

The Department has forwarded to EPA all but one RACT plan for the utility sector in the subject five-county area. That one plan is for USX Powerhouse, a small facility representing little more than 3% of the total utility emissions.

The most significant utility plan on which EPA has not yet acted is for Cromby, the second largest utility source in the area. Cromby represents 18% of the utility emissions. The RACT plan for Cromby was forwarded to EPA as a SIP amendment on 1 August 1995.

The following table lists the status of RACT submittals for the most significant sources in the five-county area:

Facility:	Potential To Emit:	Status:	EPA Action:
Eddystone	23647	To EPA Aug 95	Approved
Cromby	7230	To EPA Aug 95	None
Limerick	3010	To EPA Dec 95	None
USX Power Hse	3003	New Owner '97 - Incomplete	

Falls Sta	1515	Feb 95 Presumptive	N/A
Moser Sta	1515	Feb 95 Presumptive	N/A
Chester Sta	1515	Feb 95 Presumptive	N/A
Croydon	1296	To EPA Jul 97	None

The remaining utility units in the area not approved by EPA are minor combustion turbines, smaller boilers, and diesel engines.

The lengthy EPA processing period is not limited to the Philadelphia area or utility sector plans. Of the 85 RACT SIP plans forwarded to EPA for the area, only 12, or 15% of the total, have been acted on by EPA. The Commonwealth has rechecked all claimed VOC and NOx RACT reductions in the Phase II Plan to assure that credit is only taken for those sources submitted to EPA as SIP revisions. Following is a table listing submission dates for these sources.

NOx RACT			
Company	**County**	**NEDS ID**	**Date Submitted**
PECO Energy, Cromby	Chester	0023	8/1/95
Transcontinental Pipeline	Chester	0047	8/1/95
Sun Refining & Marketing	Delaware	0025	5/21/96
Philadelphia Baking	Philadelphia	3048	4/16/96
VOC RACT			
Company	**County**	**NEDS ID**	**Date Submitted**
Fasson-Div of Avery	Bucks	0040	6/10/96
PECO Energy - Cromby	Chester	0023	8/1/95
ICI/LNP	Chester	0057	11/15/95
Norwood Industries	Chester	0042	7/2/97
Philadelphia Baking	Philadelphia	3048	4/16/96
Nabisco	Philadelphia	3201	4/16/96
Continental Baking	Philadelphia	5811	4/16/96

COMMENT 7: The plan fails to give a clear indication of how the conformity requirements of the Clean Air Act are met under this plan. (3,4)

RESPONSE: The Department agrees that it is difficult to pinpoint a exact figure in the plan which identifies highway emissions for purposes of establishing a transportation conformity budget. This information is now provided only in the appendix. The Department has revised the plan by adding a transportation conformity section which establishes budgets for 1999, 2002 and 2005.

COMMENT 8: *Pennsylvania should submit refined modeling in accordance with EPA's December 29, 1997 guidance once final NOx budgets are established by rulemaking. (4)*

RESPONSE: Pennsylvania, New Jersey, Delaware and Maryland intend to continue modeling the Philadelphia area as necessary, particularly with regard to the 8-hour ozone standard.

COMMENT 9: *It would be useful if the submission would contain additional documentation including how to obtain detailed modeling information, more precise identification of modeled control strategies, what data bases were used, relationship of boundary conditions to OTAG strategies, color tile maps, difference plots for each strategy from the base case, emission sensitivity analysis showing the magnitude of reductions necessary for attainment, committee member lists and references to Appendix V. (4)*

RESPONSE: Additional documentation has been added to the modeling section. Inquiries for specific detailed information regarding the Philadelphia domain modeling efforts should be forwarded to DEP who will, in conjunction with EOSHI, provide necessary information. The volume of data files prohibits their being supplied even as an appendix.

Updating the committee member list requires coordination between several states and a formal amendment procedure with approval. This task will be undertaken during the next round of modeling and protocol development.

COMMENT 10: *The submission should improve explanations of why only two episodes were modeled and how ozone trends provide a compelling weight of evidence argument for attainment. (4)*

RESPONSE: While three episodes were modeled, only two episodes were run for "future" scenarios. These runs were chosen according to the availability of regional (ROM) future base case and control strategy simulations. A complete explanation of episode selection is located on page 9 of the "Ozone SIP Modeling TECHNICAL SUPPORT DOCUMENTATION SUMMARY for the New Jersey - Philadelphia CMSA Area". This document is part of Appendix V.

Wording has been added to Section 4 stating that current trends provide a compelling "weight of evidence" argument that current NOx and VOC controls are leading the area toward attainment.

COMMENT 11: *The submission should include a statement regarding changes in EPA guidance, modeling tools and databases. (4)*

RESPONSE: The suggested statement has been added to Section 5.3.2.

COMMENT 12: The Rate of Progress Appendix III labels the factors used to calculate the target levels erroneously. There are inconsistencies between this appendix and the target levels as referred to in the body of the plan. There are also inconsistencies between appendix and body of the plan for uncontrolled emissions. (4)

RESPONSE: Appendix III contains a listing of the data needed to calculate the target level of emissions for 2002 and 2005 in accordance with the *Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration* - the relevant EPA guidance on the calculation. In response to this comment, DEP is altering some of the tables to clarify the exact calculation process and to correct any errors or inconsistencies. In response to those inconsistencies noted which were the result of rounding, DEP has edited the plan to provide background data at a precision of ±1%.

COMMENT 13: Several modifications to tables and charts were suggested to add clarity and to provide information necessary for other programs. In addition, recommendations were made to add information to narrative descriptions contained in the plan. (4)

RESPONSE: DEP appreciates the suggestions and has added several tables in the plan to provide this information.

COMMENT 14: There are differences between Appendix III E and Tables 3a/b in point source credit calculations. (4)

RESPONSE: The relevant table in Appendix III has been updated.

COMMENT 15: It is unclear how the emission factor was used to determine reductions from Stage II Vapor Recovery was obtained. (4)

RESPONSE: The section in Appendix III of the plan that describes the Stage II Vapor Recovery program has been updated.

The 1990 emission factor was obtained from AP-42 by combining the emissions factors for Stage II reductions and spillage to determine the total refueling losses. The projected uncontrolled data is based on growth in fuel sales which was determined for the base year from State tax data and projected using VMT as a surrogate. The projected controlled emission factors are now calculated with Mobile5b and consider both the Stage II and the onboard vapor recovery programs. These factors also include spillage losses so they also comprise the total projected controlled refueling losses.

COMMENT 16: Pennsylvania should detail how the emission reductions from spark-ignition nonroad engines under 25 hp were generated. Pennsylvania should document its sources. EPA's new standards allow these engines to increase NOx by 98 percent; DEP should take this into account. (4)

RESPONSE: The calculation methodology for emissions reductions for nonroad engines are based on the EPA Environmental Fact Sheet entitled *Summary of EPA's Nonroad Engine Control Programs* (February 1997) - as opposed to the 1994 dated memo cited by the EPA in its comments - and is detailed in Appendix III.

The 32% VOC reduction from Phase I (as opposed to the 59.2% VOC reduction from both phases) was used in calculations because the EPA-provided methodology was much less clear in its discussion of Phase II control application.

As the EPA noted in its comments, the calculation methodology suggested by their guidance document could not be followed precisely because it requires that the inventory be broken down by horsepower rating. Since the EPA mandated use of inventory data provided by the EPA Office of Mobile Sources for the Philadelphia CMSA which does not provide the data in that form, another method was necessary.

To compensate for lack of details in EPA-provided inventories, DEP limited its credit calculation to lawn and garden equipment. The EPA-provided inventory data shows that over 99.9% of the VOC emissions from this category comes from spark-ignition engines. In addition, 98% of the VOC emissions from this category come from sources with an average horsepower rating of less than half of the 25hp limit and the vast majority of equipment averages less than 5hp.

If the extreme conservative assumption is made that the one spark-ignition engine class within the lawn and garden category with an *average* power rating of over 25hp contained *only* engines with an actual power rating of over 25hp, DEP methodology would overpredict reductions by less than half a ton. Assuming credit from Phase I controls on recreational vehicles alone would compensate for this. Contrary to EPA's comment, based on the EPA-provided inventory, DEP continues to believe that full credit for these standards to the entire lawn and garden category would be offset by other small engine inventory categories. DEP fully supports EPA's comment that a more detailed inventory would be useful and encourages the EPA to insure that the new methodology they are developing provide the necessary details.

No adjustments to the NOx inventory were made in response to this program because the EPA-provided guidance document made no indication what the actual changes in NOx emissions would be as a result of Phase I reductions. The commentator suggested a 98% increase in NOx is allowable, yet the document states that NOx reductions of up to 40% are expected from Phase II of the controls which should be in place prior to 2002. It seems apparent that only a small percentage of the inventory could show increases from Phase I before the reductions from Phase II are in effect. EPA's comment on this issue appears to be inconsistent with their recommendation to assume credit from Phase II controls.

If EPA is able to provide a better methodology for developing the nonroad inventory and applying the controls to small spark-ignition engines, DEP will update these calculations.

COMMENT 17: Pennsylvania should detail how it derived its estimated percentage reduction from Tier 1 emission levels for nonroad diesel engines over 50 hp. (4)

RESPONSE: The calculation methodology for emissions reductions for nonroad engines are based on the EPA Environmental Fact Sheet entitled *Summary of EPA's Nonroad Engine Control Programs* (February 1997) - as opposed to the 1994 dated memo cited by the EPA in its comments - and is detailed in Appendix III. This document cites a projected 60% NOx reduction of all compression-ignition (diesel) engines manufactured after 1999.

THE COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

FINAL
STATE IMPLEMENTATION PLAN (SIP) REVISION FOR THE
ATTAINMENT AND MAINTENANCE OF THE
NATIONAL AMBIENT AIR QUALITY STANDARD FOR
OZONE

MEETING THE REQUIREMENTS OF THE
ALTERNATIVE OZONE ATTAINMENT DEMONSTRATION
POLICY

PHASE I OZONE SIP SUBMITTAL

AUGUST 1, 1998

HTTP://WWW.DEP.STATE.PA.US

1. Executive Summary

Ground-level ozone continues to be the primary air pollution problem in Pennsylvania. While successes have been won in many parts of the state, the Philadelphia Metropolitan area still exceeds the one-hour health-based standard for ozone on numerous occasions during the summer months. Reducing concentrations of ground-level ozone is important because ozone levels above the health-based standard are a serious human health threat, and also can cause damage to important food crops, forests, and wildlife. Ozone in the troposphere, also called ground-level ozone, should not be confused with stratospheric ozone – located in the upper atmosphere – which protects the earth by blocking out damaging solar radiation.

Ozone is not emitted directly to the atmosphere, but is formed by photochemical reactions between volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) in the presence of sunlight. The long, hot, humid days of summer are particularly conducive to ozone formation, so ozone levels are of general concern during the months of May through September.

The primary sources of man-made VOCs and NO_x, the ozone precursors, are the evaporation of fuels and solvents (gasoline and consumer products), combustion of fuels (motor vehicles, power plants, and other industries), and chemical and industrial processes.

The Clean Air Act, as amended in 1990 (CAA), requires states to design strategies to reduce ozone and its precursors in order to meet the rate-of-progress requirements and the health-based standard. The five counties in southeast Pennsylvania are part of a four-state ozone nonattainment area. (See Map 1) Because parts of all four states affect one another, the air quality planning must be coordinated for the entire area; Pennsylvania's counties cannot be redesignated to attainment unless, for example, New Jersey's counties can also demonstrate attainment of the health-based standard for ozone, and vice versa. This multi-state nonattainment area is classified as "severe" nonattainment for ozone, and as such has until 2005 to reach attainment of the one-hour standard of 0.12 parts per million (ppm). The requirements for a severe non-attainment area are described in Sections 110 and 172 of the CAA. In accordance with these requirements and EPA policy, states are permitted to design plans that demonstrate progress toward attainment in a stepwise fashion, by meeting interim "milestones" at various points between 1990 and 2005.

To meet these requirements, on November 12, 1994 Pennsylvania submitted the required Rate-of-Progress and Attainment Plan, which was deemed complete by action of law six months later. On October 25, 1996, the United States Environmental Protection Agency (EPA) proposed to disapprove the submission for several reasons, one of which was the lack of several pieces of information required for 1999.

On March 2, 1995, EPA issued a policy establishing an alternative attainment process whereby states could commit to a two-phased approach to meet the statutory requirements.[1] The Phase I requirements include adoption of specific control strategies necessary to meet the Post 1996 Rate-of-Progress plan through 1999; commitments to adopt, or adoption of, other CAA-mandated and regional control programs; and modeling with interim assumptions. The Phase II requirements include participation in a two-year regional consultative process with other states in the eastern United States and with EPA to identify and commit to additional emission reductions necessary to attain the health-based ozone standard by the statutory dates. Pennsylvania committed to this alternative two-phased approach in a letter sent to EPA on May 31, 1995. In addition to these requirements, Pennsylvania must fulfill all ozone non-attainment obligations due to be completed before November 15, 1994 before EPA will approve plans based on the two-phased approach.

As a result, the Commonwealth is required to submit the Phase I portion of the State Implementation Plan (SIP) revision, including the 1999 24% emission reduction milestone (15% from 1990 through 1996, plus 3% per year from 1996 through 1999). In this SIP revision, Pennsylvania demonstrates that it can meet the 24% emission reduction target. *Table 1* presents the control measures included in the plan.

In addition, as this SIP contains various commitments necessary to meet the requirements of Phase I, it also serves as a "Committal SIP." Section 7.5 of the Pennsylvania Air Pollution Control Act sets out special procedures for processing committal SIPs. Details about the specific commitments are contained in Section 3.

A total of 616 tons per summer day (tpsd) of VOCs were emitted by man-made sources in 1990. This number serves as the 1990 baseline, and is adjusted in accordance with the CAA to 576 tpsd *(see Table 2 for the calculation of the 1990 adjusted baseline).* The Post-1996 Rate-of-Progress requirement for an average 3% reduction per year may include reductions in both VOCs and NO_x. This SIP must also offset emissions growth that occurs between 1990 and 1999, and must include an additional 17 tpsd of reductions from contingency measures. The contingency measures must be implemented if the 24% reduction is not achieved. The calculation of the 1999 milestone emission target is detailed in *Table 3.*

A total reduction of 189 tpsd is required to meet the 1999 Rate-of-Progress milestone and to offset growth. State, local, and federal control measures have been adopted or are pending which will lead to VOC reductions of 146 tpsd, and NO_x reductions equivalent to 110 tpsd of VOCs, a total reduction of 256 tpsd that are creditable toward the ROP reduction requirements. In addition, contingency measures

[1] Memorandum from Mary D. Nichols, Assistant Administrator for Air and Radiation, EPA, to Regional Administrators entitled "Ozone Attainment Demonstrations" dated March 2, 1995. (included in Appendix I)

are planned that will lead to 18 tpsd of VOC reductions and NOx reductions equivalent to 2 tpsd of VOC. *Table 1* presents the measures that will yield these reductions.

This Phase I SIP revision provides a complete 1999 inventory and other program details and as such will rectify the specific deficiencies which led to EPA's October 25, 1996 proposal to disapprove Pennsylvania's November 1994 Rate-of-Progress submission as it relates to the 1999 Rate of Progress Plan.

Table 1
Control Measures Used to Attain the 1999 ROP Requirements

Area Source Controls
- Architectural and Industrial Maintenance Surface Coatings (AIM)
- Stage II Vapor Recovery (80% Rule Effectiveness)
- Transportation, Storage, and Disposal Facilities
- Autobody Refinishing
- Consumer Products

Point Source Controls
- VOC and NO_x RACT
- RACT fix-ups
- NO_x Memorandum of Understanding

Highway Vehicle Controls
- Tier I/FMVCP
- Enhanced Inspection and Maintenance
- Reformulated Gasoline

Contingency Measures
- Rule Effectiveness 80-90%
- Source and Process Shutdowns

Table 2 Calculation of the 1990 Adjusted Baseline (VOC)	
all values in tons per summer day (tspd)	
1990 VOC Baseline	616
FMVCP/RVP*	-39
1990 Adjusted Baseline	***576***
** Federal Motor Vehicle Control Program/Reid Vapor Pressure*	

Table 3 Calculation of Emission Reduction Target Levels			
all values in tons per summer day (tpsd)			
Prior Target Level – 1996		**Current Target Level – 1999**	
1990 VOC Baseline	616	1996 Target	494
Fleet Turnover Correction	-33	9% Reduction	-52
RACT Fix-Ups	-<1	Fleet Turnover Correction	-6
15% Reduction	-87	***1999 Target***	***436***
1996 Target	***494***		

NOTE: All numbers in the preceding tables are rounded to the nearest ton; therefore, some discrepancies may exist.

Chart 1 - 1990 VOC Emissions (Adjusted Baseline)

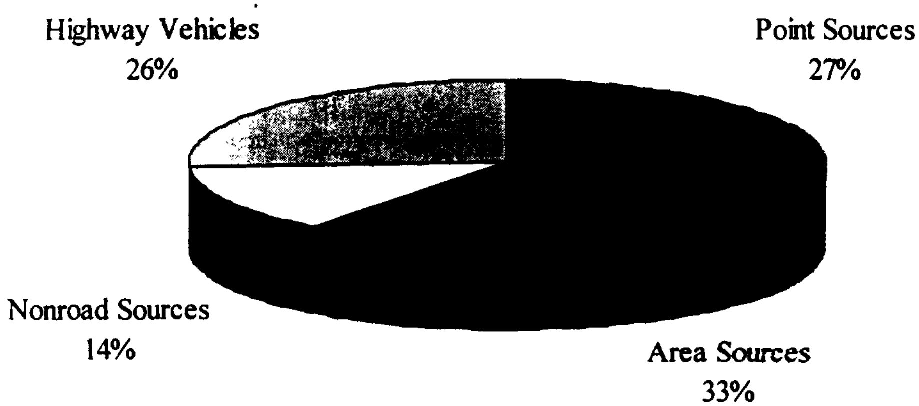


Chart 2 - 1990 NOx Emissions (Adjusted Baseline)

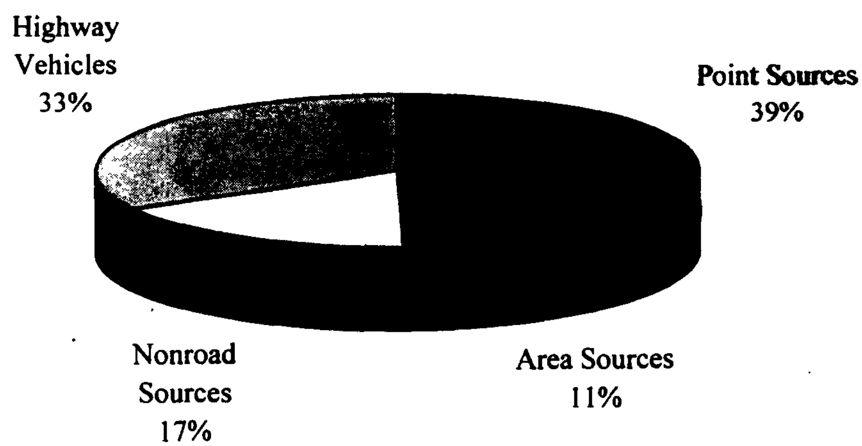


Chart 3 - 1999 VOC Emissions
(Projected Controlled)

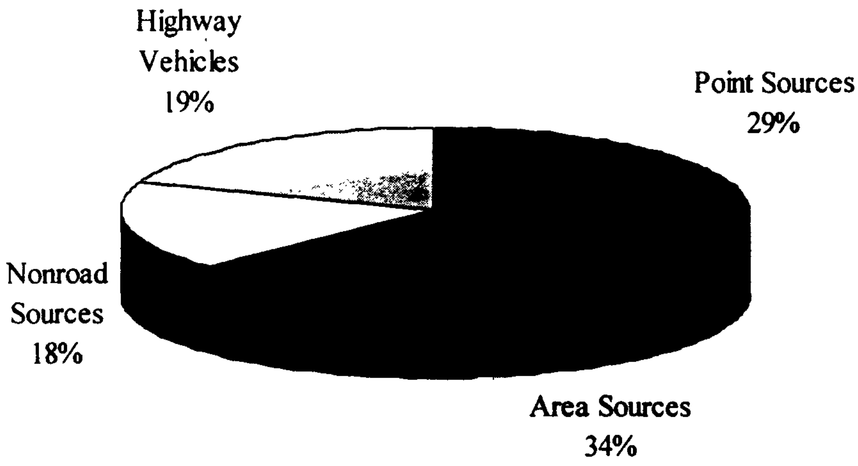


Chart 4 - 1999 NOx Emissions
(Projected Controlled)

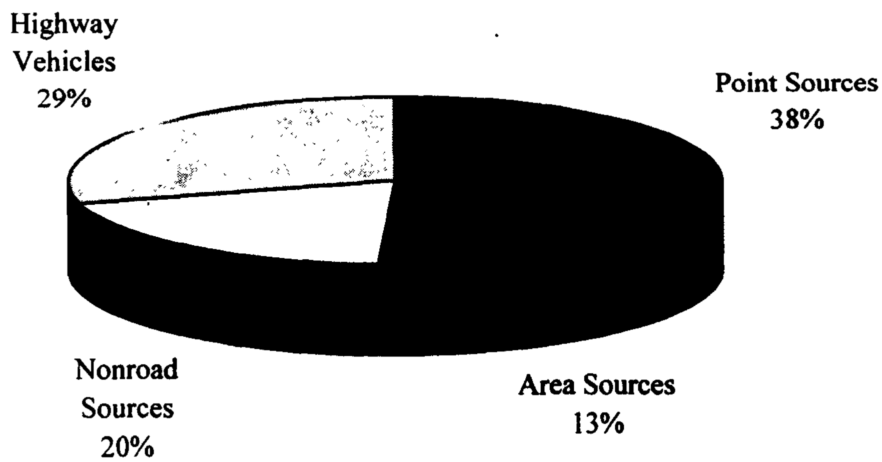


Chart 5 - 1999 ROP VOC Reductions By Source Category

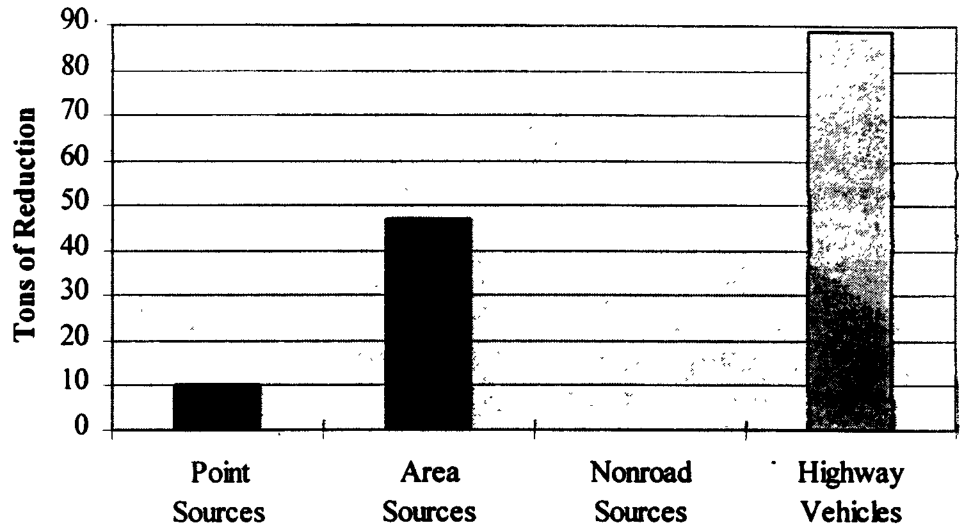
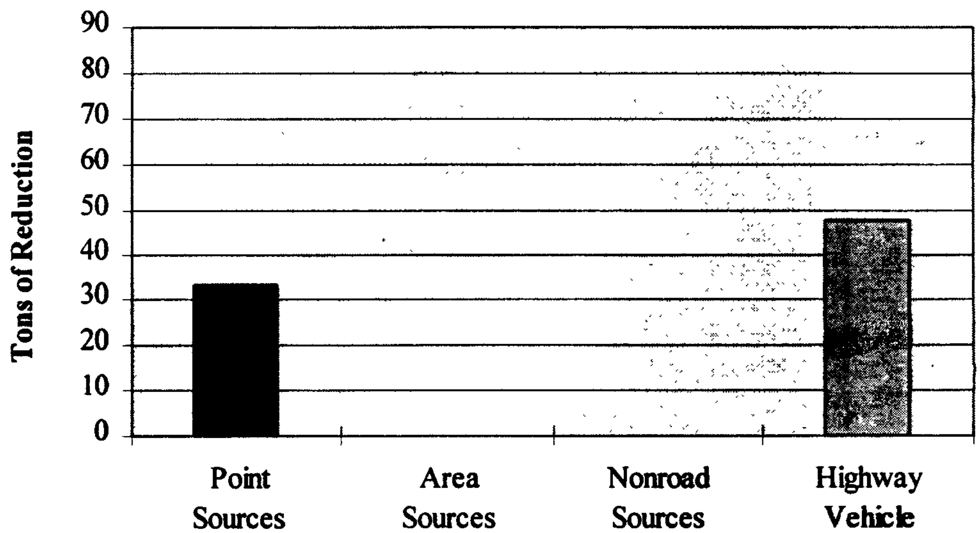
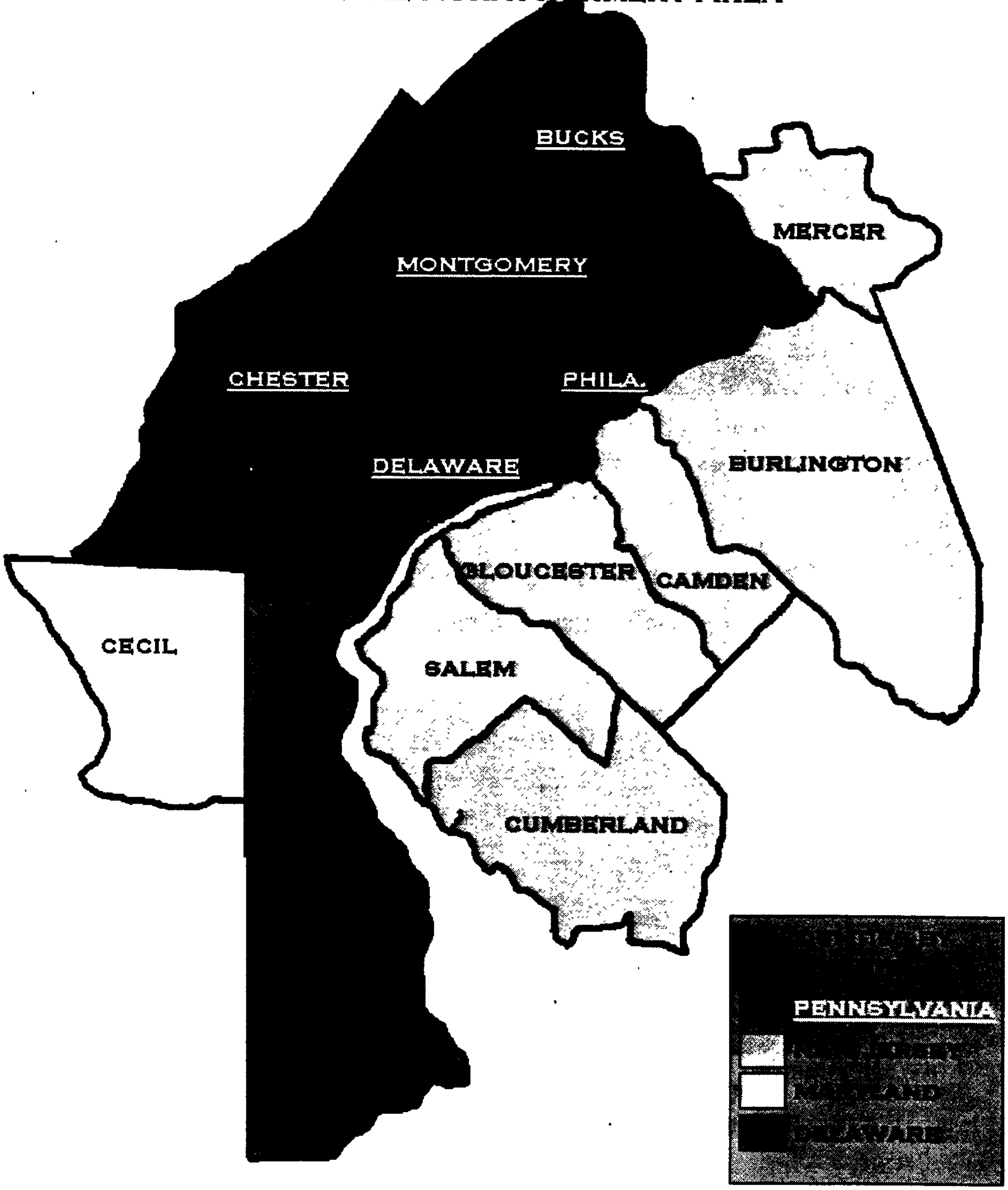


Chart 6 - 1999 ROP NOx Reductions By Source Category



Note: NO_x reductions are shown in actual tons of NO_x, not VOC-equivalent reductions

Map 1 - Philadelphia Interstate Ozone Nonattainment Area



2. Overview

2.1 The Ozone Problem – Why It Is Important To Lower Concentrations of Ozone

The Clean Air Act requires the federal Environmental Protection Agency (EPA) to establish national health-based standards for six major air pollutants. Attainment of the health-based standard for one of those six – ground-level ozone – continues to be Pennsylvania's biggest challenge. The Clean Air Act, as amended in 1990 (CAA), redesigned the process states must follow to develop attainment plans, classified non-attainment areas based on the extent of the ozone problem, and extended attainment dates.

Reducing concentrations of ground-level ozone is important because ozone is a serious human health threat; it also can cause damage to important food crops, forests, and wildlife. Ground-level ozone should not be confused with stratospheric ozone – located high above the ground in the upper atmosphere – which protects the earth by blocking out damaging solar radiation.

Ozone is a difficult pollutant to deal with because it is not emitted directly, but rather is formed by complex chemical reactions of ozone precursors – volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) – in the presence of sunlight. The long, hot, stagnant days of summer are particularly conducive to ozone formation, so ozone levels are of general concern during the months of May through September. VOC emissions have origins as diverse as automobiles, chemical manufacturing, paint shops, and other sources using solvents, while NO_x emissions are produced primarily by fuel combustion in industrial and transportation sources.

Ozone causes human health problems because it damages lung tissue, reduces lung function, and sensitizes the lungs to other irritants. Scientific evidence indicates that ambient levels of ozone not only affect asthmatics and others with impaired respiratory systems, but also healthy adults and children, especially those who exercise or work outside. Exposure to ozone for several hours at relatively low concentrations has been found to significantly reduce lung function and induce respiratory inflammation in healthy people during exercise. This decrease in lung function generally is accompanied by symptoms including chest pain, coughing, sneezing, and pulmonary congestion.

2.2 Summary of the "Two-Phased" Attainment Demonstration Process

Pennsylvania is responsible for developing air quality plans for the five Pennsylvania counties of the Philadelphia Interstate Ozone Nonattainment Area – Bucks, Chester, Delaware, Montgomery, and Philadelphia counties. These counties are part of a four-state ozone non-attainment area; counties in New Jersey, Delaware, and Maryland are also included because ozone is not a local problem. (see Map 1 for the entire area) In fact, the entire nonattainment area must be in attainment before counties in any of the four states can be designated as attainment. This plan describes the status of the Pennsylvania counties' progress toward meeting the 1999 Rate of Progress (ROP) plan required emission reductions.

The ROP requirement – demonstration of VOC-equivalent reductions of at least three percent per year from 1996 until attainment – is stipulated in the CAA. "Severe" non-attainment areas, such as the five-county Philadelphia area, were required to submit a State Implementation Plan (SIP) by November 15, 1994 to meet the annual three percent ROP requirements for 1996 through 2005, and demonstrate that enforceable measures would bring the area into attainment with the one-hour ozone standard no later than 2005. Pennsylvania submitted a ROP and attainment SIP on November 12, 1994. EPA did not propose any formal action on the submission, and as a result, after six months the SIP was deemed complete by action of law. Later, on October 25, 1996 EPA proposed to disapprove the submission for several reasons; that proposal has not been finalized.

Most other states facing the same requirement, including all of the northeastern states, were unable to submit their plans by the November 15, 1994 deadline. Realizing that many states, especially those that were affected to some degree by interstate transport of ozone and ozone precursors, were having great difficulty developing credible attainment plans, EPA issued a policy outlining an alternative approach. This so called "Two-Phased" approach, issued in a memo signed by EPA Assistant Administrator for Air and Radiation Mary Nichols on March 2, 1995[2], allows states much more flexibility in their planning efforts. Pennsylvania agreed to the alternative approach in a letter to EPA dated May 31, 1995.

Under this two-phased approach, Pennsylvania and other states will demonstrate progress toward attainment of the one-hour health-based standard for ozone in two separate phases. In Phase I, geared toward achieving local emission reductions, PA must submit a plan to implement specific control measures to reduce emissions of VOCs by 24% by 1999 from 1990 levels. Fifteen percent of those reductions were to be achieved by 1996; the remaining 9% is to be met in reductions of 3% per year from 1996 through 1999. Phase I also requires submission of any photochemical modeling completed to

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[2] Memorandum from Mary D. Nichols, Assistant Administrator for Air and Radiation, EPA, to Regional Administrators entitled "Ozone Attainment Demonstrations" dated March 2, 1995. (included in Appendix I)

date, an enforceable commitment to participate in consultations to address regional transport, adoption of any additional control measures necessary to meet ROP requirements, and consideration of emission reductions from upwind areas that may be needed for attainment. Phase I is to be used to demonstrate a commitment to adopt any necessary rules to implement the Ozone Transport Commission (OTC) NO_x Memorandum of Understanding (MOU) and either the National Low Emission Vehicle (NLEV) program or a state LEV program. *Table 4* displays the status of each of the Phase I requirements.

Table 4 : Meeting the Phase I Requirements in Pennsylvania

Requirement	Action
Implementation of Pre-1994 Requirements	
• Stage II Vapor Recovery	EPA approved
• VOC RACT	Rules submitted
• NO_x RACT	Rules submitted
• Enhanced I/M	Interim Conditional Approval, 2/28/97
• Reformulated Gasoline	Federal program; implemented 1/1/95
• Clean Fuel Fleet	NLEV/LEV substitution
• 15% Rate of Progress Plan	Interim Conditional Approval, 6/7/97, 12/30/97
Letter Committing to Two-Phase Approach	Submitted 5/31/95
Plan to implement OTC NO_x MOU	Rule submitted to EPA 12/19/97
Plan to Implement NLEV/LEV	Published proposed rule in Pennsylvania Bulletin, 11/29/97
Enforceable Commitments • Participate in a Consultative Process to Address Transport • Identify Reductions from Upwind States • Implement Additional Control Measures, As Necessary	Contained in this Submittal
1999 24% Rate of Progress Plan	Contained in this Submittal
Attainment Modeling Completed to Date	Submitted 11/12/94

Phase II is designed to address the more difficult task of actually attaining the one-hour health-based standard – especially dealing with transport of ozone and ozone precursors – by implementing regional control strategies. Most areas of the Northeast, including the Philadelphia area, will be unable to attain and maintain the one-hour health-based standard for ozone without a consistent level of emission reductions throughout the entire Midwestern and Southeastern United States. States that have committed to the two-phased process are required to participate in discussions designed to reach consensus on what controls are necessary for meaningful reductions of ozone and ozone precursors.

The controls chosen must create enough emission reductions so that the photochemical modeling included in the Phase II submission shows attainment of the one-hour ozone standard across the entire non-attainment area. Work done by the Southeast Pennsylvania Ozone Stakeholder Working Group (Stakeholders) will be the focus for the selection and design of additional controls necessary in Pennsylvania. Emission reductions to be achieved through implementation of the recommendations from the Ozone Transport Assessment Group (OTAG) are necessary to reduce upwind ozone and ozone precursors.

In addition, both Pennsylvania and EPA are taking action to address the transport of pollutants into Pennsylvania. On August 14, 1997, Pennsylvania filed a petition with EPA under Section 126 of the Clean Air Act (a copy of that petition is available upon request). The Petition requests that EPA establish emission limitations for certain large sources of NO_x to reduce transported air pollution. Similarly, on October 10, 1997 EPA announced a proposal to require 22 states and the District of Columbia to submit SIPs that address the regional transport of ozone and ozone precursors. In that rule, EPA made a proposed finding that "22 States and the District of Columbia significantly contribute to nonattainment in, or interfere with maintenance by, a downwind State."

The Phase I SIP was supposed to be submitted sometime during the 1996 calendar year. Pennsylvania – and every other state subject to the two-phase approach – was unable to meet that deadline. As a result, EPA published a notice of Pennsylvania's failure to submit the Phase I plan on May 17, 1997, with an effective date of May 7, 1997. This publication started an 18-month sanction clock for Pennsylvania. EPA must publish a completeness determination for Pennsylvania's Phase I submission that is effective on or before November 7, 1998 or mandatory sanctions will go into effect.

2.3 What This SIP Submission Contains

This 1999 ROP plan outlines a strategy for achieving a 24% reduction in VOC equivalent emissions between 1990 and 1999. Fifteen percent of those reductions were accounted for in Pennsylvania's 15% Plan SIP submission to EPA on September 12, 1996, and will not be discussed in any detail here. Therefore, the focus of this plan is on the reductions of 3% per year from 1996 through 1999, and an additional 3% reduction beyond the 9% from programs called contingency measures – programs that will be implemented if Pennsylvania fails to achieve actual reductions of 24% by 1999. Unlike the 1996 15% reduction SIP, the Phase I plan may incorporate reductions of NO_x, expressed as VOC equivalents, to meet the goal.

Emission reductions are achieved by controlling VOCs and NO_x in four categories of emission sources from human activity. The four categories are:

- *Point Sources* – utilities, industries, and other operations that emit more than a certain amount of VOCs or NO_x per year

* *Area Sources* – industrial/commercial sources too small or too numerous to be handled individually, solvent use, waste disposal, and other categories
* *Nonroad Engine Sources* – construction and agricultural equipment, recreational boats, lawnmowers, and similar sources
* *Highway Vehicle Sources* – cars, trucks, buses, and motorcycles

While emissions from natural, or biogenic, sources do play a role in the formation of ground-level ozone, they are not addressed as part of this plan. However, they will be accounted for in the overall attainment demonstration to be submitted as part of Phase II.

2.3.1 Control Strategies

The emission reductions outlined in this plan come primarily from federal and state measures designed to reduce pollution from activities related to the use of motor vehicles. Sixty-seven percent of the VOC and VOC-equivalent tons of reductions achieved in 1999 (171 tons per day) come from highway vehicle controls, fuel reformulation, and vapor recovery during gasoline refueling.

Since the late 1960's, many of the older cars that were manufactured before catalytic converters and numerous other advances in pollution control technology were standard features on every car have been replaced by new cars that produce up to 98% less pollution. Reformulated gasoline, which has been sold year round in the Philadelphia area since January 1, 1995, has had an immediate impact on the levels of VOCs. The inspection and maintenance program that has been in place since 1984 has had a positive impact, but the enhanced program, that began in October 1997 and is included in this plan, uses more sensitive equipment, so it is better able to identify the so-called "gross" polluters. Since all vehicles are tested annually, reductions from this program are immediate and continuing. Stage II vapor recovery, now fully implemented, can lower emissions from vehicle refueling at gas stations by 95 percent. Added together, these programs have had a prodigious effect on emission reductions – an effect that will continue through 1999.

The continuing control of point, or stationary, sources contributes about 22 percent of the projected reduction in emissions from the implementation of the Ozone Transport Commission Nitrogen Oxide Memorandum of Understanding, reasonably available control technology (RACT), increased rule effectiveness, and through facility shutdowns. Most of the big emission reductions from point sources occurred in the 1970s and 1980s when initial controls were installed. From 1996 through 1999, the point sources are essentially "fine tuning" their emission controls, applying rule effectiveness (a more efficient application of existing regulations), or shutting down portions of their operations.

Area sources are also contributing ROP reductions. Federal requirements to reformulate autobody paints, personal care products, household paints, industrial coatings, wood and roof coatings, and traffic line paints have lead to a reduction in the VOC content in all of these products. Pennsylvania is permitted to take credit for the emission reductions from all these federal programs. The area sources programs are regulated on the federal level because the Clean Air Act required EPA to regulate these sources nationally; it is much more efficient to set national standards when dealing with such wide spread emission sources. Pennsylvania-specific rules for products such as deodorant or glass cleaner could be overly burdensome for manufacturers and would possibly lead to price increases. To avoid these pitfalls, EPA regulates and enforces most area sources nationally.

The emission control strategies used to achieve the reductions required in this submission are listed in *Table 1*, and described in detail in the Rate of Progress Plan section.

3. Commitment SIP Section

3.1 Air Pollution Control Act Obligations

Section 7.5 of the Pennsylvania Air Pollution Control Act (APCA) establishes certain process and analysis requirements for SIPs that "commit the Commonwealth to adopt air pollution control measures or procedures." These committal SIPs are reviewed by the Environmental Quality Board. The review of a committal SIP precedes and is in addition to the review and adoption process required of all the Department's specific rulemakings. In addition, all SIPs are subject to federal and state public comment period requirements.

The commitments for future action that this SIP submission contains are those required by Phase I of EPA's alternative approach to planning for and attaining the one-hour ozone National Ambient Air Quality Standard (NAAQS). This document does not contain any specific recommended future control strategies in addition to those already adopted by the Commonwealth, but rather contains a commitment to adopt any control strategies deemed necessary in the future in accordance with the process defined by the APCA and any other applicable laws.

3.2 Commitments for Future Action

The Commonwealth hereby commits to:

a) continue to participate in a consultative process to address regional transport;
b) continue to identify emission reductions needed from upwind states;
c) adopt additional control measures, as necessary, to meet future rate of progress requirements and attain the one-hour ozone NAAQS.

These commitments are submitted as part of this Phase I 1999 ROP SIP revision and will become enforceable commitments by the Commonwealth.

3.3 Discussion of Commitments for Future Action

A) *Continue to participate in a consultative process to address regional transport*

Satisfaction of this requirement is clearly demonstrated by Pennsylvania's past involvement in and continuing commitment to the Ozone Transport Assessment Group (OTAG). Pennsylvania was an active participant – DEP's Deputy Secretary for Air, Recycling and Radiation chaired the Emissions Trading Workgroup – and remains fully committed to implementing the control programs reached by consensus. Pennsylvania has high expectations that the OTAG resolutions will bring about significant reductions in the concentrations of transported ozone and ozone precursors.

B) *Continue to identify emission reductions needed from upwind states*

The transport (movement) of ozone and its precursors, VOC and NO_x, into and out of the five-county area, was discussed by the Southeast Pennsylvania Stakeholders. The Stakeholders expect other regions to adopt similar levels of control to positively impact southeastern Pennsylvania's air quality.

Since the Stakeholders Final Report in January 1997, two important follow-up actions have occurred to deal with transported ozone and ozone precursors:

First, Gov. Tom Ridge filed a petition on August 14, 1997 with EPA asking it to take action to reduce air pollution coming into the Commonwealth from other states. Section 126 of the federal Clean Air Act gives states the ability to require EPA to address the issue of transport of pollution. Pennsylvania is using Section 126 to petition EPA in an effort to reduce emissions from a category of air pollution sources – large fossil-fuel fired combustion units and electric generating facilities – in most of the OTAG region. The petition requests moderate levels of reductions at these sources now, with an assessment to follow to determine if additional reductions are necessary. Pennsylvania has agreed to do the same with its sources. The petition requests that EPA establish specific emission limitations and reductions on the affected units in the 19 named states, as well as a schedule for compliance, if necessary.

EPA and the states that filed Section 126 petitions, including Pennsylvania, entered into a scheduling agreement for EPA action. That action provides:

"a) By April 30, 1998, EPA agrees to take preliminary action on the petitions (advanced notice of proposed rulemaking).
b) By September 30, 1998, EPA will publish a notice of proposed rulemaking, and will hold a public hearing within 30 days after the notice is published.
c) By April 30, 1999, EPA will take final action on the petitions.
d) EPA must propose to approve a state or federal plan by November 30, 1999, and give final approval by May 1, 2000. Otherwise, the requirements of an approved §126 petition will be in effect."

Second, on October 10, 1997, EPA proposed a "Finding of Significant Contribution and Rulemaking for Certain States in the OTAG Region for Purposes of Reducing Regional Transport of Ozone." This action, under Section 110 of the federal Clean Air Act, proposes SIP calls for 22 states and the District of Columbia.

These SIP calls would require affected states to reduce NO_x emissions to levels specified in the proposal. Individual states could choose how to achieve those reductions. The proposal calls for final requirements to be set in September 1998 and for states to submit required regulations and plans by September 1999. The reductions are to be achieved by September 2002. EPA has indicated that these reductions are necessary for meeting the one-hour health standard for ozone and are a central component for meeting EPA's new ozone standard that was made final in July 1997. The proposed strategy was developed by EPA to implement the cooperatively- developed recommendations of the 37 OTAG states. Without reductions in upwind emissions from Midwestern and Southeastern states, it will not be possible for Pennsylvania to achieve the one-hour ozone standard in the Philadelphia Interstate Ozone Nonattainment Area.

C) *Adopt additional control measures, as necessary, to meet future rate of progress requirements and attain the one-hour ozone NAAQS*

Pennsylvania is committed to doing its fair share to attain the one-hour health-based ozone standard. Pennsylvania recognizes that attainment and maintenance of the standard is not possible without significant reductions in ozone and ozone precursors from states to the west and south of Pennsylvania. These reductions in transported ozone need to be part of the boundary conditions used in Pennsylvania's attainment demonstration.

Pennsylvania also recognizes that a modeling attainment demonstration has substantial technical limitations. These limitations in a model's ability to predict ozone improvement due to projected emission reductions may be so significant that alternative methods for demonstration of attainment will need to be considered. Pennsylvania commits to the development and implementation of control measures and requirements in accordance with the process provided in the APCA and other applicable laws that, along with reductions in transport, will result in reductions necessary for satisfaction of reasonable further progress requirements and attainment of the one-hour ozone standard.

Pennsylvania will continue to involve EPA and the public in the development of any additional control measures and requirements. Pennsylvania has received and is in the process of implementing recommendations from the Southeast Pennsylvania Ozone Stakeholder Working Group. These recommendations will form a basis for evaluating additional control measures and requirements, should additional local measures be deemed necessary to meet statutory requirements.

4. 1990 Base Year Inventory

4.1 Geography

Most of the Commonwealth's major urban areas were designated as nonattainment for ozone after finalization of the 1990 Clean Air Act Amendments. *Map 2* shows these areas. The Philadelphia nonattainment area is classified as severe nonattainment for ozone. The Pennsylvania portion of the Philadelphia Interstate Ozone Nonattainment Area includes the counties of Bucks, Chester, Delaware, Montgomery, and Philadelphia.

The Philadelphia nonattainment area is a multi-state area covering parts of New Jersey, Delaware, and Maryland. This plan refers only to the five county Pennsylvania portion of the nonattainment area. (See *Map 1* for the entire area.)

4.2 Background

The CAA and 42 U.S.C.A. §7511a(a)(1) requires states containing ozone nonattainment areas to develop a "comprehensive, accurate and current inventory of actual emissions from all sources." EPA has interpreted "current" to mean an inventory for calendar year 1990.

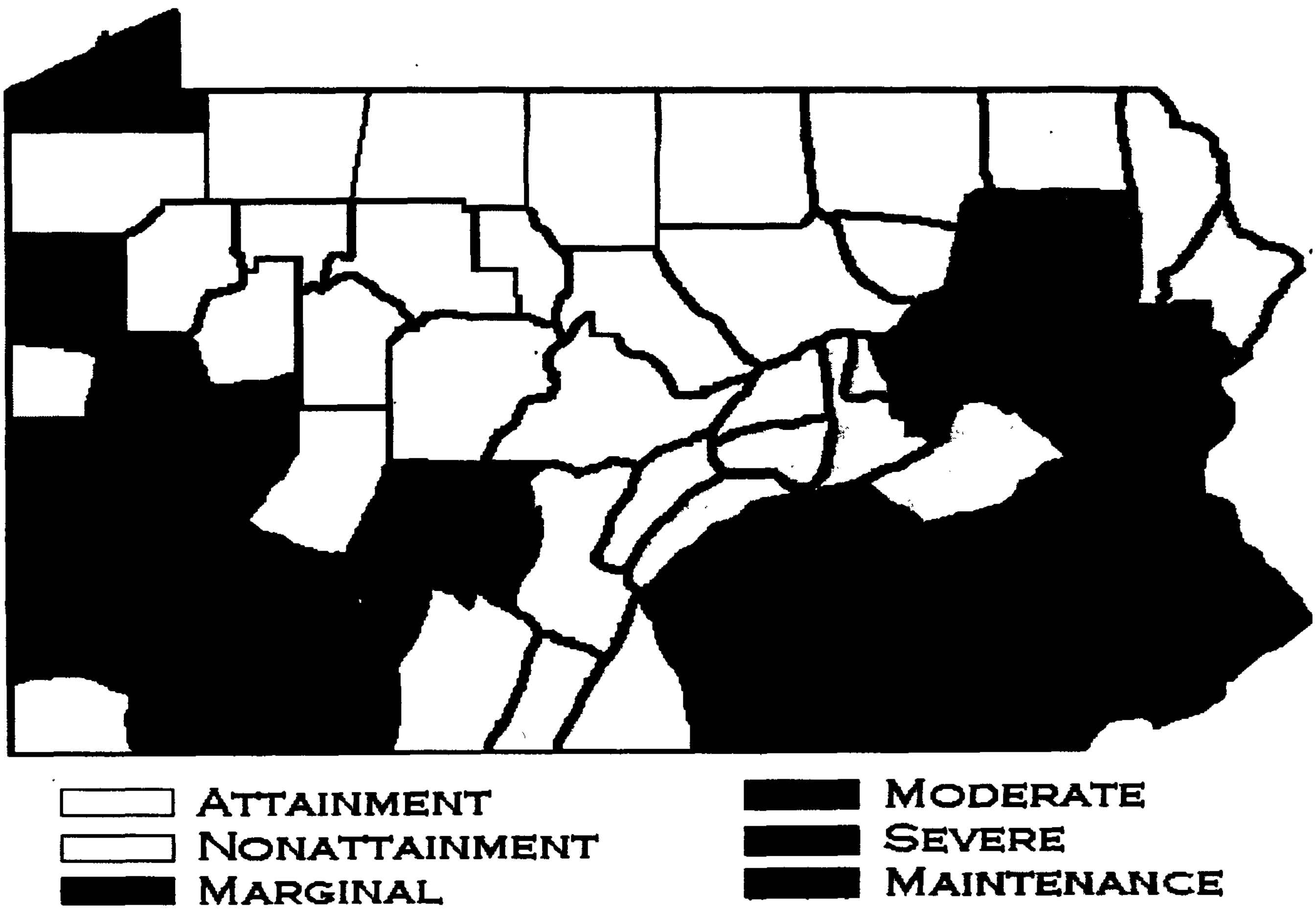
The inventory represents the emissions that are produced and emitted to the air during the "peak" ozone season – the time of year when pollutants and meteorology are most likely to interact in such a way that high concentrations of ground-level ozone are created. Pennsylvania's peak ozone season occurs during the summer months. Unless otherwise specified, all daily emissions given refer to a "typical" summer weekday, and are given in tons per summer day (tpsd).

The 1990 VOC base year inventory was last revised and submitted to EPA with the 15 percent ROP Plan. The public hearing for that plan and inventory was held on July 22, 1996. On June 7, 1997, EPA issued conditional interim approval of that SIP revision.

This submission establishes the 1990 NO_x base year inventory. The NO_x data contained in this plan supersedes all prior submissions. Prior SIP submissions with NO_x inventory methodology and documentation will remain on file with EPA.

Federal requirements preclude a rule from taking effect until EPA submits a rule report to each House of the United States Congress and to the Comptroller General of the General Accounting Office (GAO). EPA recently discovered that it had failed to submit the 1990 base year inventory and 15 percent plan as required, thus although the rule was promulgated on July 9, 1997, by operation of law the rule did not take effect on that date. When EPA discovered its error, the rule was submitted to both Houses of Congress and the GAO on December 11, 1997. With this action, the effective date of the conditional interim approval was changed to December 30, 1997.

Map 2 – Pennsylvania Nonattainment Area Designations by County



4.3 Source Types

The 1990 Base Year Inventory is a compilation of the emissions from sources of anthropogenic (human-made) VOC, biogenic (natural) VOC, sources of anthropogenic oxides of nitrogen (NO_x), and carbon monoxide (CO) into the outdoor air. The sources are categorized into five components:

- Point sources
- Area sources
- Nonroad engine sources
- Highway vehicle sources
- Biogenic sources

Biogenic sources are not required to be addressed in this submission; therefore, there will be no assessment of their contribution to the emissions inventory. Biogenic emissions will be addressed as part of the Phase II/attainment demonstration submission.

4.3.1 Point Sources

The Pennsylvania Department of Environmental Protection (DEP) is the agency responsible for compiling the point source inventory. DEP is responsible for identifying point sources whose emission levels are high enough to meet applicable cutoff criteria, documenting the method used to calculate emissions from each source, and summarizing and presenting the findings. Philadelphia Air Management Services compiles the point source inventory for Philadelphia County; that information is incorporated in the overall inventory.

Chart 7a is a summary of point source VOC emissions by major categories, *Chart 7b* is a summary of point source NO_x emissions by major categories. Emissions are depicted as a percent of the total point source inventory and have been adjusted for seasonable variability and rule effectiveness. The six major emissions categories are reported in accordance with EPA reporting requirements. The total point source emissions for VOC and NO_x, by county, are listed in *Table 5a* and *Table 5b* respectively. A detailed description of the method used to compile the point source list and a description of the emissions estimation procedure are contained in the 15% ROP Plan.

Table 5a – Summary of the 1990 VOC Point Source Emissions Inventory (in tpsd)

Category	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
Storage, Trans., & Mkting	0.02	0.33	14.59	0.67	6.72	
Industrial Processes	1.32	1.26	16.53	3.54	17.72	
Industrial Surface Coating	18.69	6.12	32.95	1.74	9.70	
Other Solvent Use	1.54	7.76	2.99	1.73	1.46	
Waste Disposal	0.00	0.00	0.02	0.00	0.00	
Misc. Sources	0.42	1.01	1.52	0.10	2.29	
TOTAL:	**22.00**	**16.48**	**68.60**	**7.78**	**37.89**	**152.75**

Chart 7a – 1990 VOC Point Source Emissions Inventory

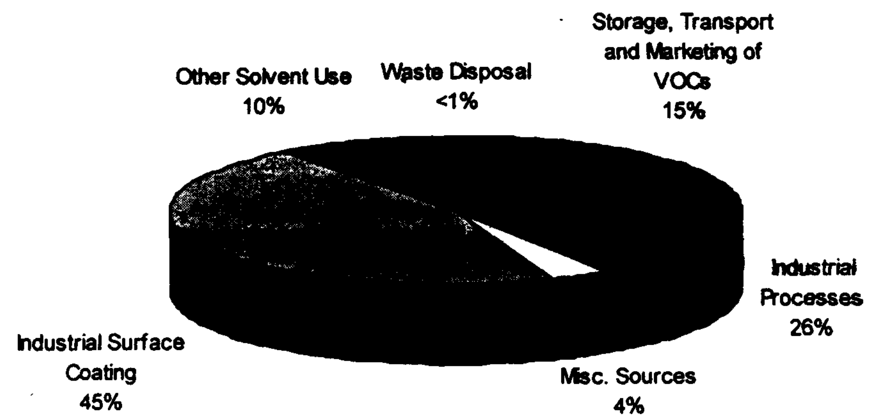
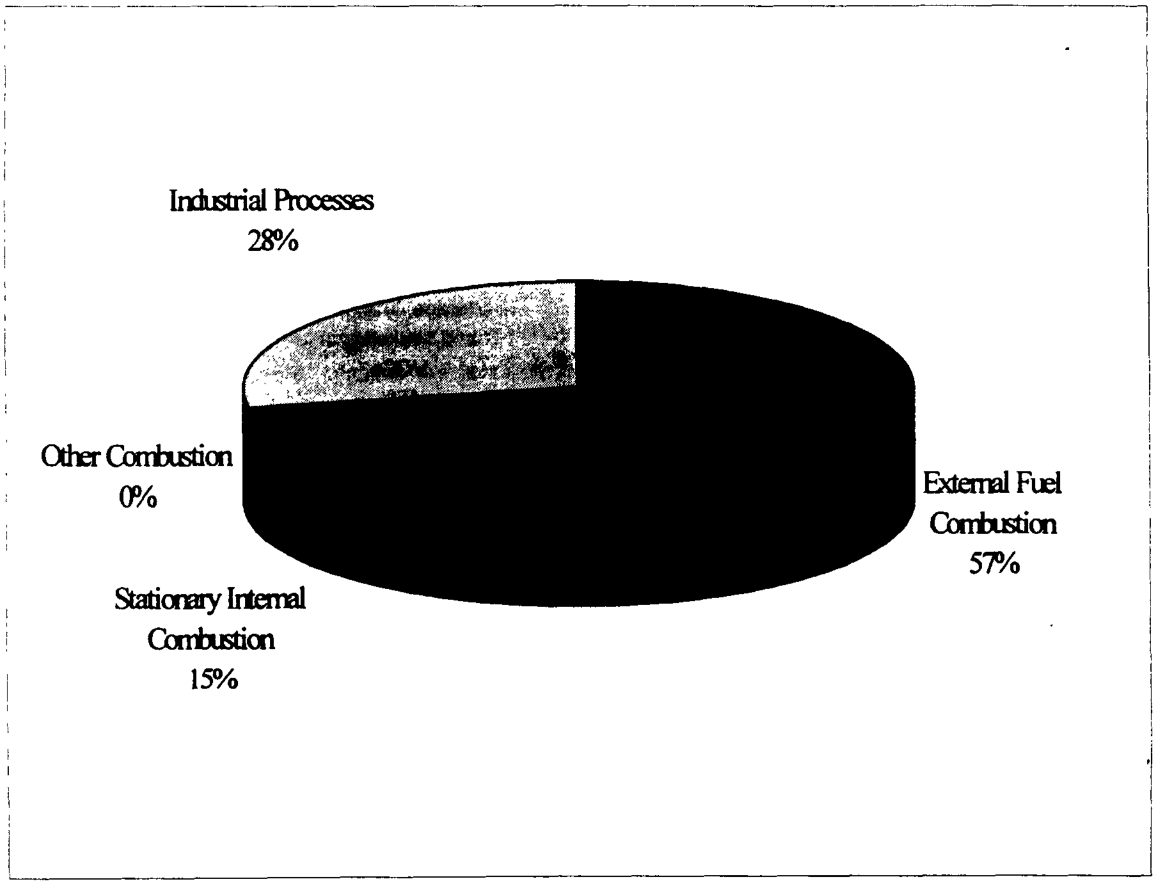


Table 5b – Summary of the 1990 NO_x Point Source Emissions Inventory (in tpsd)

Category	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
External Fuel Combustion	3.35	11.51	43.14	5.13	29.69	
Stationary Internal Combustion	4.75	13.65	2.84	0.60	1.98	
Other Combustion	0.00	0.01	0.02	0.04	0.36	
Industrial Processes	7.86	1.80	19.51	1.90	13.75	
TOTAL:	**15.96**	**26.97**	**65.51**	**7.67**	**45.79**	**161.90**

Chart 7b – 1990 NOx Point Source Emissions Inventory



4.3.2 Area Sources

The area source inventory contains the information necessary to estimate emissions collectively for those sources that are too small or too numerous to be handled individually in the point source inventory.

The EPA-approved methodology used to calculate each source category is included in Appendix IV to the 15% ROP Plan. *Table 6a* and *Table 6b* summarize each category's contribution by county to VOC and NO_x emissions; *Chart 8a and Chart 8b* depict the VOC and NO_x inventories by category.

Table 6a – Summary of the 1990 VOC Area Source Emissions Inventory (in tpsd)

Category	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
Transportation	0.23	0.08	5.04	1.38	1.65	
Industrial Processes	16.60	9.35	12.29	26.15	35.27	
Combustion	0.11	0.07	0.14	0.18	0.43	
Gasoline Marketing	5.09	4.03	3.29	6.68	6.54	
Waste Disposal	0.86	1.61	1.05	9.29	9.22	
Consumer/ Commercial	5.31	4.19	5.03	6.43	14.50	
Misc. Evaporative	0.33	0.24	0.34	0.42	0.98	
TOTAL:	28.53	19.56	27.18	50.51	68.58	194.35

Chart 8a – 1990 VOC Area Source Emissions Inventory

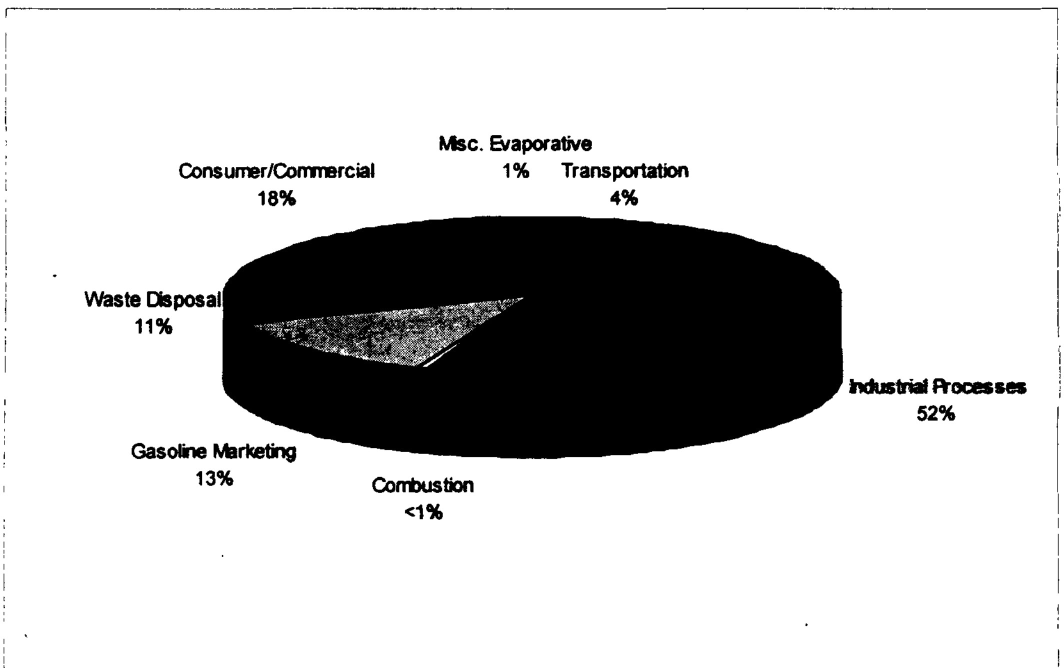
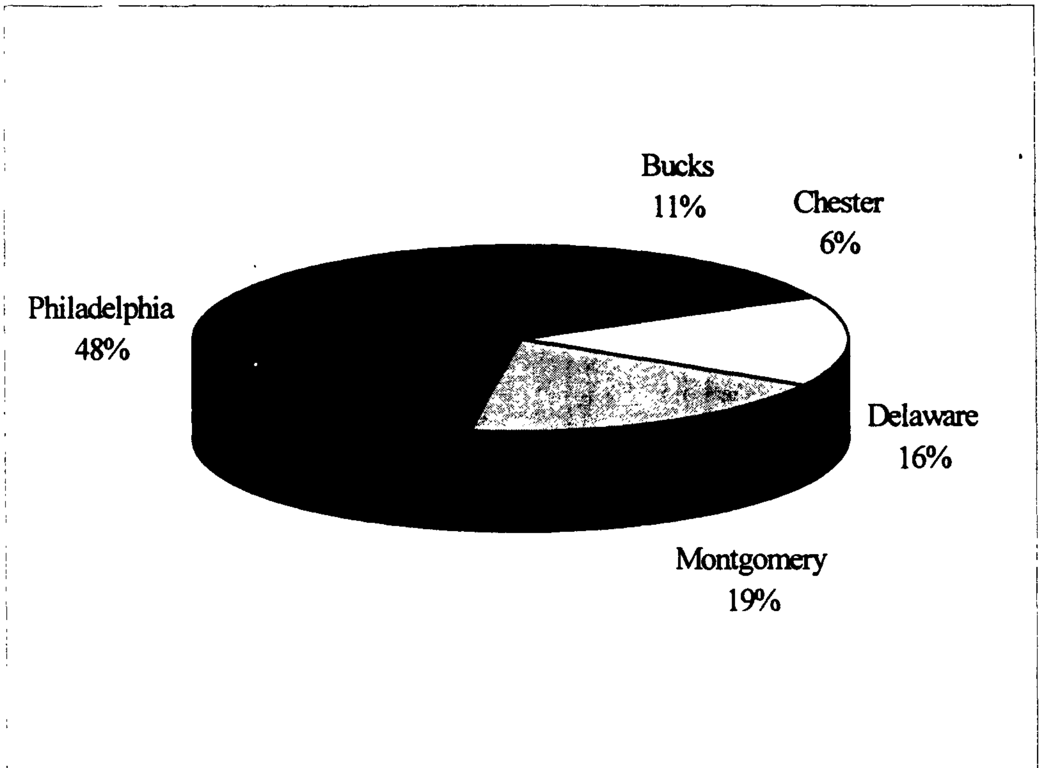


Table 6b – Summary of the 1990 NO_x Area Source Emissions Inventory (in tpsd)

	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
TOTAL:	5.36	2.84	7.45	9.13	22.34	47.12

Chart 8b – 1990 NO_x Area Source Emissions Inventory



4.3.3 Nonroad Engines

The "Other Nonroad Engines and Vehicles" category includes a diverse collection of equipment such as lawn mowers, chain saws, recreational equipment, farm equipment, and construction machinery. A study was conducted by the EPA in November 1991 of emissions from nonroad engines and vehicles. The study determined whether emissions from such sources cause, or significantly contribute to, air pollution that may be anticipated to endanger public health or welfare.

4.3.3.1 Methods

When conducting the November 1991 study, EPA considered more than 80 different types of equipment. To simplify analysis and reporting, EPA grouped the equipment types into the 10 equipment categories listed below:

- Lawn and Garden Equipment
- Agricultural Equipment
- Logging Equipment
- Light Commercial Equipment
- Industrial Equipment
- Construction Equipment
- Airport Service Equipment
- Recreational Equipment
- Recreational Marine Equipment
- Commercial Marine Vessels.

Two emission inventories were developed by EPA for the first nine categories for 24 ozone and carbon monoxide nonattainment areas across the country. DEP uses the inventory developed by EPA based on commercially and publicly available data. Further discussion of the methodology is available in the 15% ROP plan.

The Philadelphia ozone nonattainment modeling domain emission estimate of 81 tons per day was drawn from the spreadsheets, prepared by EPA's Office of Mobile Sources, for the Philadelphia Interstate Ozone Nonattainment Area. *Table 7a* and *Table 7b* present a breakdown by county and the total emissions of VOC and NO_x. *Chart 9a* and *Chart 9b* depict the VOC and NO_x emissions calculated by engine type.

Table 7a – Summary of the 1990 VOC Nonroad Engine Emissions Inventory (in tpsd)

Category	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
Lawn and Garden	8.14	6.44	6.57	11.65	14.10	
Airport Equipment	0.00	0.00	0.00	0.00	0.85	
Recreational Equipment	0.43	0.54	0.00	0.00	0.00	
Recreational Vessels	3.09	3.97	1.11	2.36	1.39	
Light Commercial Equipment	0.90	0.71	0.69	1.65	1.62	
Industrial Equipment	0.65	0.43	0.50	1.23	1.24	
Construction Equipment	1.38	1.04	1.21	2.49	2.26	
Agricultural Equipment	0.50	0.74	0.02	0.32	0.00	
Logging Equipment	0.09	0.11	0.03	0.11	0.01	
TOTAL:	15.18	13.98	10.13	19.81	21.47	80.56

Chart 9a – 1990 VOC Nonroad Engine Emissions Inventory (by Engine Type)

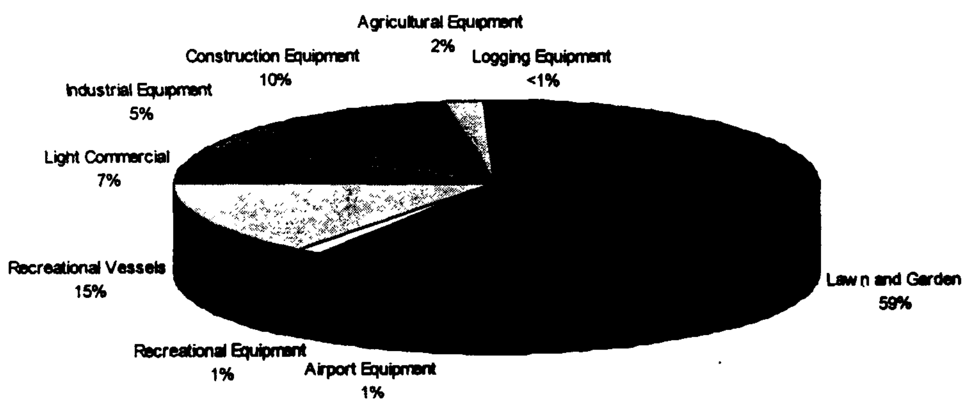
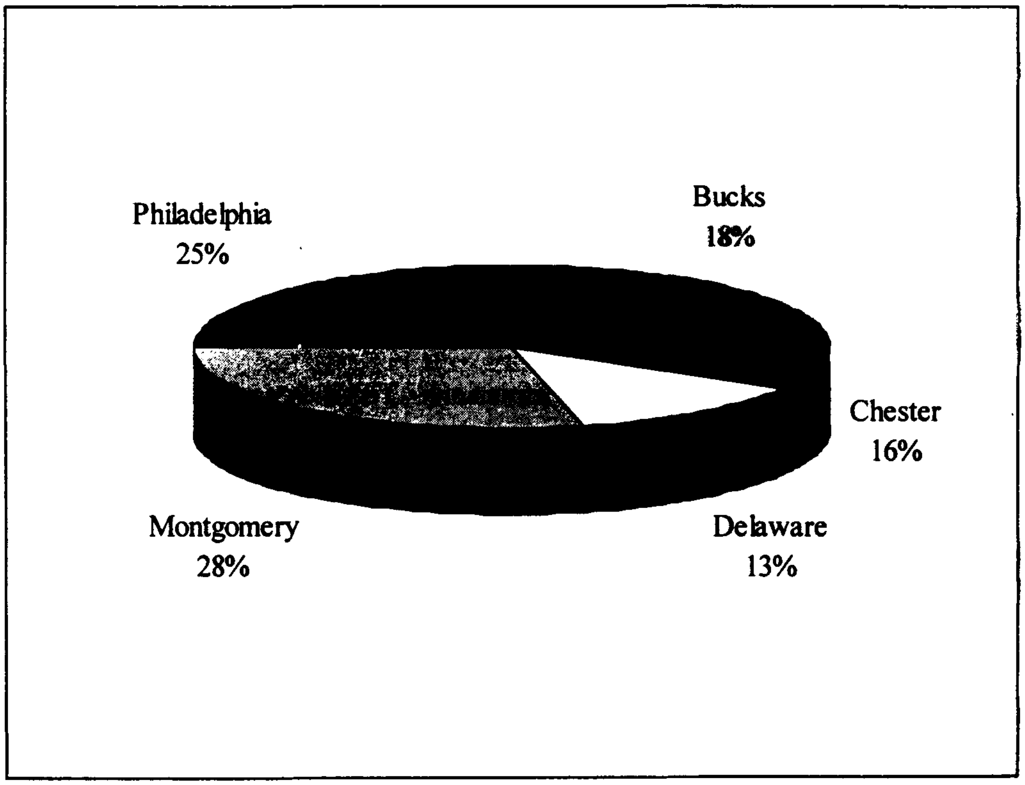


Table 7b – Summary of the 1990 NO_x Nonroad Engine Emissions Inventory (in tpsd)

	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
TOTAL:	**13.09**	**11.25**	**9.23**	**20.69**	**17.94**	**72.20**

Chart 9b – 1990 NO_x Nonroad Engine Emissions Inventory (by Engine Type)



4.3.4 Highway Vehicles

Highway vehicle emissions comprise a significant portion of Pennsylvania's emission inventory. This impact is due to both tailpipe and evaporative emissions from vehicles operating in both urban and surrounding areas. DEP has coordinated with the Pennsylvania Department of Transportation (PennDOT) to develop the necessary data to produce highway vehicle emission estimates.

Pennsylvania's emission inventory includes the following vehicle classifications:

1. LDGV - Light-Duty Gasoline Vehicles
2. LDGT1 - Light-Duty Gasoline Trucks (<6,500 lbs)
3. LDGT2 - Light-Duty Gasoline Trucks (<8,500 lbs)
4. HDGV - Heavy-Duty Gasoline Vehicles (>8,500 lbs)
5. LDDV - Light-Duty Diesel Vehicles
6. LDDT - Light-Duty Diesel Trucks (<8,500 lbs)
7. HDDV - Heavy-Duty Diesel Vehicles (>8,500 lbs)
8. MC - Motorcycles

The inventory illustrates each county's emissions. The data and methods presented in the inventory represent the Commonwealth's approach based on EPA guidance. The MOBILE Model is used for calculating emissions factors. The MOBILE Model is the only methodology approved by EPA to calculate highway vehicle emissions. It is supported by the Post Processor for Air Quality (PPAQ). (See Section 6.5 for a description of each phase of the highway vehicle emissions projections.)

The results of the highway vehicle emissions modeling for VOC and NO_x are summarized in *Chart 10a* and *Chart 10b* and detailed in *Table 8a* and *Table 8b* and in Appendix V. A detailed description of the methodology can be found in the 15% ROP Plan, Appendix IV.

Table 8a – Summary of the 1990 VOC Highway Vehicle Inventory Emissions (in tpsd)

Category	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
LDGV	30.51	18.67	19.98	35.78	56.03	
LDGT1	1.54	1.19	0.93	1.96	2.72	
LDGT2	1.24	0.96	0.70	1.51	2.00	
HDGV	0.47	0.35	0.29	0.57	0.77	
LDDV	0.27	0.18	0.20	0.35	0.44	
LDDT	0.03	0.02	0.02	0.04	0.05	
HDDT	0.27	0.21	0.18	0.36	0.41	
MC	1.32	1.00	0.87	1.73	1.78	
TOTAL:	35.65	22.57	23.16	42.31	64.21	187.89

Chart 10a – 1990 VOC Highway Vehicle Emissions Inventory (by Vehicle Type)

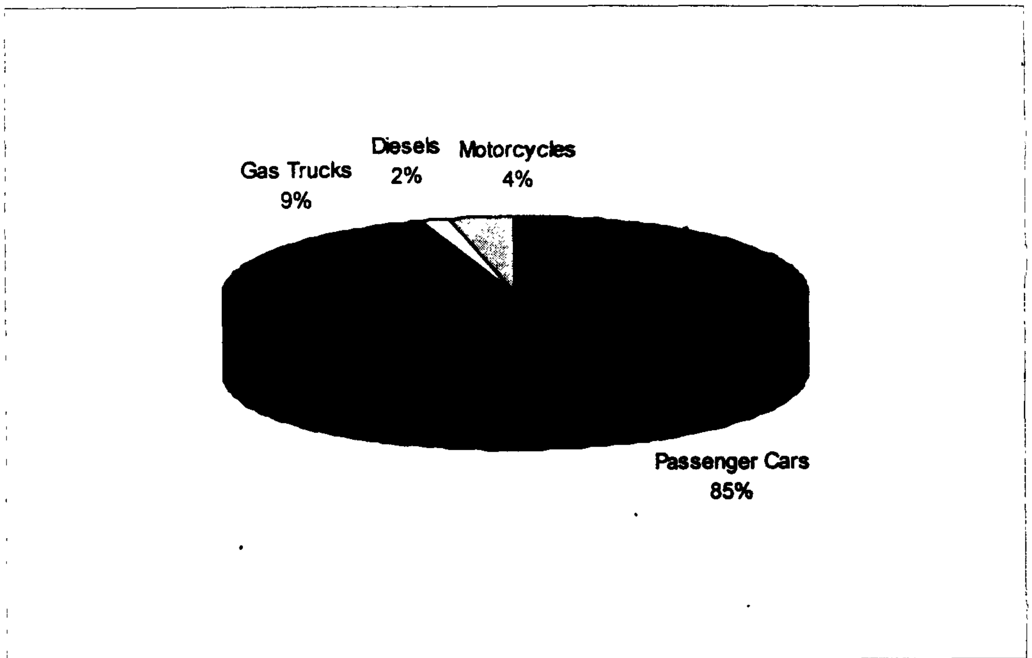
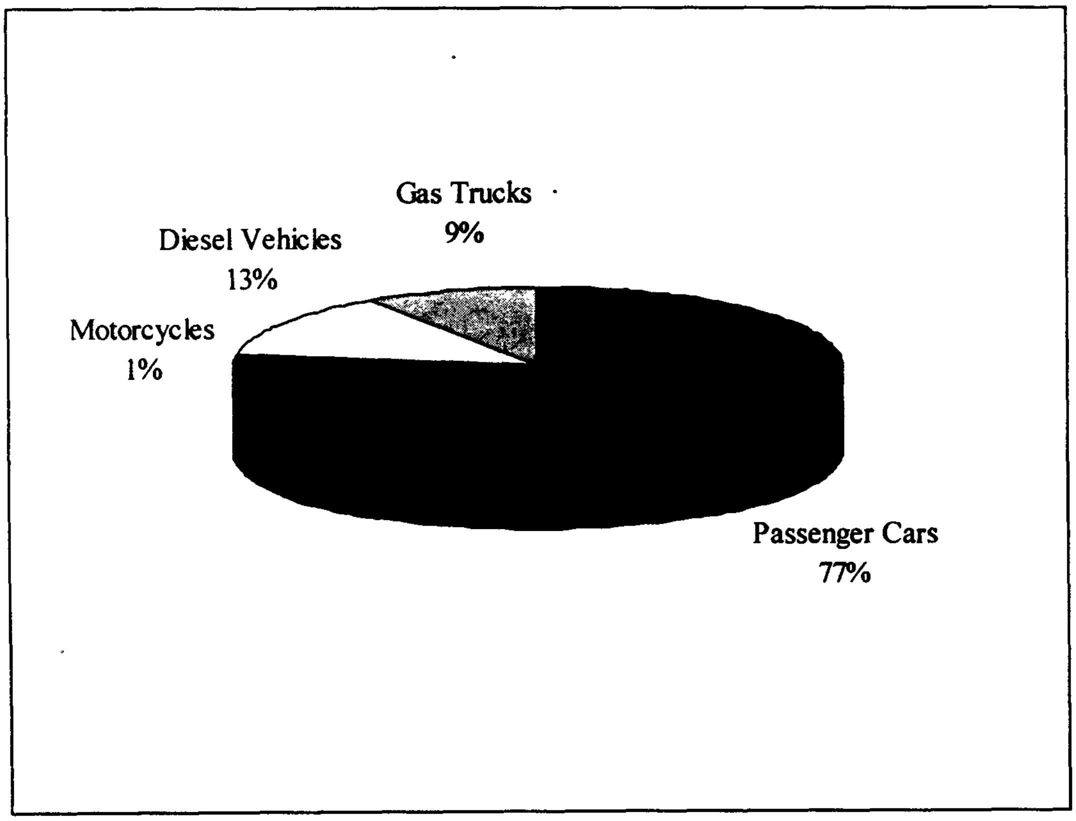


Table 8b – Summary of the 1990 NO_x Highway Vehicle Inventory Emissions (in tpsd)

Category	Bucks	Chester	Delaware	Montgomery	Philadelphia	Total
LDGV	24.98	19.44	14.39	30.41	32.83	
LDGT1	1.40	1.30	0.75	1.73	1.91	
LDGT2	1.08	1.00	0.55	1.30	1.41	
HDGV	0.45	0.41	0.25	0.55	0.57	
LDDV	0.98	0.78	0.60	1.26	1.24	
LDDT	0.10	0.09	0.06	0.13	0.14	
HDDV	2.99	2.81	1.74	3.88	3.95	
MC	0.18	0.15	0.10	0.23	0.19	
TOTAL	**32.16**	**25.98**	**18.44**	**39.50**	**42.24**	**158.32**

Chart 10b – 1990 NO_x Highway Vehicle Emissions Inventory (by Vehicle Type)



5. 1999 Emissions Target Level

In order to determine which control strategies – in addition to the mandated federal programs – are necessary to achieve the required VOC or VOC-equivalent emission reductions by 1999, DEP must calculate the target level of emissions for the applicable milestone year. This section explains the procedures used for calculating the target level of emissions for 1999. Calculation of the 1996 milestone year target level – used in steps 4, 5, and 6 – is contained in the 15% ROP plan.

Emissions and emission reductions for the 1999 plan are calculated on a typical weekday basis for the peak three-month ozone period of June, July, and August. The documentation will show the three percent per year emission reduction levels averaged over the period between 1996 and 1999.

In this section, the calculation methodology will be presented and explained, followed by the actual calculation of the 1999 target level of emissions.

5.1 1999 Target Level – Calculation Methodology

The target level of emissions represents the maximum amount of emissions that the nonattainment area can emit for the target year and still comply with the 1999 rate-of-progress plan requirements. This section outlines the general approach to calculating the target level of emissions and proceeds through a detailed description of the calculation.

The following equations, which describe the calculation of the 1999 target level, can be generalized into one equation:

***TARGET LEVEL** = (previous milestone's target level) - (reductions required to meet the rate-of-progress requirement) - (fleet turnover correction term).*

The equation can also be expressed in terms of variables:

$$TLx = TLy - BGr - FTx$$

where:

x	=	Current milestone or attainment year
y	=	Year of previous milestone
TLx	=	Target Level of emissions for year x (tons/day)
TLy	=	Target Level of emissions for year y (tons/day)
BGr	=	Emission reduction requirement for year x (tons/day)
FTx	=	Fleet Turnover correction term for year x (tons/day)

The target level for each milestone year (TLx) is calculated by subtracting the three percent per year rate-of-progress emission reduction (BGr) and the fleet turnover correction term (FTx) from the previous milestone year (TLy). The specific steps needed to calculate the target are discussed below.

There are six major steps in calculating the 1999 target level of emissions. The first four steps are needed to calculate the three percent per year rate-of-progress emission reductions. Steps 1 and 2, developing the 1990 base year inventory and the 1990 rate-of-progress base year inventory, were previously submitted by DEP in the 15% ROP plan for the Pennsylvania counties in the Philadelphia Interstate Ozone Nonattainment Area. The inventories contained in the 15% ROP plan were prepared in accordance with the EPA document entitled "Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15 Percent Rate-of-Progress Plans."

Step 1: ***Develop the 1990 base year inventory***

The total 1990 base year emissions from the five emission source types (point, area, highway vehicle, nonroad and biogenic) were compiled. There have been no changes to inventory between submittal of the 15 percent rate-of-progress plan and the 1999 rate-of-progress plan.

Step 2: ***Develop the 1990 rate-of-progress base year inventory***

Biogenic source emissions and other emissions from sources located outside the nonattainment area, but included in step 1, were removed from the 1990 base year inventory.

Step 3: ***Calculate the 1990 adjusted base year inventory***

The CAA specifies the emissions "baseline" from which each emission reduction milestone is calculated. §182 (c)(2)(B), which is applicable based on §182(d), states that the reductions must be achieved "...from the baseline emissions described in subsection (b)(1)(B)." This baseline value is called the 1990 adjusted base year inventory. §182(b)(1)(B) defines baseline emissions (for purposes of calculating each milestone VOC and NO_x emission reduction) as "...the total amount of actual VOC or NO_x emissions from all anthropogenic sources in the area during the calendar year of enactment...."

This section excludes from the baseline the emissions that would be eliminated by federal motor vehicle control program (FMVCP) regulations promulgated by January 1, 1990, and Reid vapor pressure (RVP) regulations promulgated by the time of enactment (55FR 23666, June 11, 1990), which require maximum RVP limits for gasoline to be sold in nonattainment areas during the peak ozone season.

The 1990 adjusted base year inventory must be recalculated relative to each milestone and attainment date because the emission reductions associated with the FMVCP increase each year due to fleet turnover. Thus, the 1990 adjusted base year inventory relative to 1999 was calculated. The only adjustment that needed to be made to the inventory was to recalculate the highway vehicle emissions using MOBILE5a. This adjustment was made by calculating a separate highway vehicle emission factor for 1999. The emission factors were then multiplied by 1990 vehicle miles traveled (VMT) to yield the highway vehicle emissions that were subtracted from the 1990 rate-of-progress base year inventory to calculate the 1990 adjusted base year inventory for 1999. These reductions are calculated as follows:

FMVCP/RVP Reductions Between 1990 and 1999 *= (Actual 1990 highway vehicle emissions) - (Adjusted 1990 highway vehicle emissions)*

Where:

- Actual 1990 highway vehicle emissions = (1990 VMT) (1990 Baseline emission factors), and
- Adjusted 1990 highway vehicle emissions = (1990 VMT) (Adjusted 1999 emission factors)

The 1990 baseline emission factors were calculated using MOBILE5a runs from the 1990 base year inventory. Emission factors from these runs were used with actual 1990 VMT to calculate actual 1990 emissions.

The 1999 adjusted emission factors were calculated using MOBILE5a runs as in the 1990 base year inventory, except that year 1999 was used as the evaluation year (this will change the vehicle mix to account for fleet turnover). Emission factors from these runs were used with actual 1990 VMT to calculate adjusted 1990 emissions relative to 1999.

A detailed description of the procedure for calculating the 1990 adjusted base year inventory is provided in an EPA document entitled "Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15 Percent Rate-of-Progress Plans." The adjusted base year inventory was calculated the same way for 1999.

Step 4: ***Calculate 3 percent per year reductions***

In general, to compute the required emission reductions, the number of years between successive milestone dates should be multiplied by 0.03.

Percentage reduction = r = [0.03 * (1999-1996)] = 9%

Next, this percentage figure is multiplied by the adjusted base year inventory calculated relative to the current milestone/attainment date to yield the required emission reduction.

$$\boxed{BGr = BEx * r}$$

Where:

BGr = Emission reduction requirement for milestone or attainment date (in lb/day)
BEx = 1990 adjusted base year inventory calculated relative to year x
r = Percent reduction needed to meet the rate-of-progress requirement.

Step 5: Calculate fleet turnover correction term

In the absence of any new requirements of the CAA, there would still be some decrease in motor vehicle emission factors for many years as a result of fleet turnover; the gradual replacement of older pre-control vehicles with newer vehicles with controls. The CAA does not allow states to take credit for these reductions for rate-of-progress purposes. During the calculation of the 1999 target, these "FMVCP reductions" (along with non-creditable RVP reductions) that would occur between 1990 and 1999 were subtracted from the 1990 rate-of-progress base year inventory to calculate the 1990 adjusted base year inventory. This 1990 adjusted base year inventory was then used to calculate the required reductions and the 1999 target.

Because nonattainment areas are required to meet their 1996 targets, the calculation of the 1999 target must be based, in part, on the 1996 target. Likewise, the calculation of each subsequent target will depend, in part, on the level of the previous target. In the previous step (step 4), the adjusted base year inventory was multiplied by the total percent required reduction in order to determine the reductions required in the target year. This emission reduction requirement must then be subtracted from the emission target in the previous milestone year to calculate the new milestone target. However, one additional correction term, the fleet turnover correction, is needed to properly calculate the target.

The fleet turnover correction is needed to account for the highway vehicle emission reductions that would have occurred under the pre-CAA enactment FMVCP and RVP requirements (under 55 FR 23666) between consecutive milestone years. For example, assume that a nonattainment area has met the milestone target for 1996. The further creditable reduction required to meet the 1999 rate-of-progress requirements was calculated in step 4. However, between 1996 and 1999, there will be some additional reductions in emissions due to fleet turnover of older vehicles that are not creditable. These reductions must also be subtracted from the 1996 target to determine the 1999 target. These additional, non-creditable, reductions are referred to here as the fleet turnover correction term.

The calculation of the fleet turnover correction term is simple and does not require any additional MOBILE runs beyond what has been required in previous steps of this calculation. For the general case, the fleet turnover correction term is calculated as follows:

> ***1999 Fleet Turnover Correction*** *= 1996 Adjusted Inventory - 1999 Adjusted Inventory*

The adjusted 1990 highway vehicle emissions for 1999 was calculated earlier in step 3 as 1990 VMT times MOBILE5a emission factors for the current target year with all new Clean Air Act measures disabled and RVP set to the Phase 2 limit required in Summer 1992. The adjusted 1990 highway vehicle emissions for 1996 and 1999 were calculated using the same methodology as used in the 15% ROP plan submission.

Step 6: ***Calculate 1999 target level of emissions***

To calculate the 1999 target level of emissions, the required emission reductions calculated in step 4 and the fleet turnover correction term from step 5 are subtracted from the 1996 target level.

> ***1999 Target level*** *= (1996 target level) - (reductions required to meet the rate-of-progress requirement, calculated in step 4) - (fleet turnover correction term, calculated in step 5).*

This target represents the level of emissions that must be achieved in order for a the Philadelphia area to demonstrate compliance with the rate-of-progress requirement for 1999.

5.2 1999 Target Level of Emissions – Actual Calculation

Following the methodology described above, the actual 1999 target level of emissions is calculated in the manner detailed below.

NOTE: The numbers presented in this section are rounded to the nearest ton; therefore, when rounded numbers are added, some discrepancies may exist. For exact numbers, please refer to the inventory sections and the appendices.

Step 1: ***Develop 1990 base year VOC emission inventory (tons/day)***

Point Sources	153
Area Sources	194
Nonroad Engines	81
Highway vehicles	188
Biogenic Sources	116
Total	**732 tpsd**

Step 2: ***Develop 1990 rate-of-progress base year inventory (tons/day)***

1990 base year inventory	732
Point Sources (outside nonattainment area)	-0
Area Sources (outside nonattainment area)	-0
Highway vehicles (outside nonattainment area)	-0
Biogenic Sources	-116
Total	**616 tpsd**

Step 3: ***Calculate the 1990 to 1999 adjusted base year inventory***

This inventory was adjusted to take into account non-creditable highway vehicle emission reductions. This highway vehicle adjustment was made by calculating the highway vehicle emission factors for 1999, multiplying the emission factor by 1990 VMT, and subtracting that total from the 1990 actual highway vehicle emissions to yield the FMVCP and RVP reductions between 1990 and 1999.

1990 Actual Highway Vehicle Inventory	188
1999 Highway Vehicle Inventory, after adjustment	-148
FMVCP and RVP reductions between 1990 and 1999	**39 tpsd**

1990 Baseline Inventory	616
FMVCP and RVP reductions between 1990 and 1999	-39
1990 to 1999 Adjusted Base Year Inventory	**576 tpsd**

Step 4: ***Calculate 3 percent per year reductions***

The 1990 adjusted base year inventory calculated relative to the 1999 milestone year is multiplied by 0.09 to calculate the required emission reductions from 1996 to 1999.

1990 Adjusted Baseline	576
multiplied by 9%	x .09
9% Reduction	**52 tpsd**

Step 5: ***Calculate fleet turnover correction term***

The fleet turnover correction term is the difference between the FMVCP/RVP emission reductions calculated in step 3 and the previous milestone year's FMVCP/RVP emission reductions, which were 33 tpsd.

Previous Milestone Year's FMVCP/RVP:	
1990 Actual Highway Vehicle Inventory	188
1996 Highway Vehicle Inventory, after adjustment	-155
FMVCP and RVP reductions between 1990 and 1996	**33 tpsd**

Step 3 FMVCP/RVP	39	
Previous FMVCP/RVP	-33	
Fleet Turnover Correction Term	**6 tpsd**	

Step 6: ***Calculate target level of emissions for 1999***

To calculate the target level of emissions for 1999, the required emission reductions calculated in step 4 and the fleet turnover correction term are subtracted from the 1996 milestone target level. The 1996 target level was calculated to be 494 tpsd in the 15% ROP Plan.

Calculation of 1996 Milestone Target Level:	
1990 Baseline	616
15% Reduction	-87
RACT Fix-Ups	-1
Fleet Turnover Correction Term (shown in Step 5)	-33
1996 Target Level	**494 tpsd**

1996 Milestone Target Level	494
Required Reductions calculated in step 4	-52
Fleet Turnover Correction Term calculated in step 5	-6
1999 Target Level	**436 tpsd**

This plan must therefore demonstrate that the projected emissions for 1999, reflecting the adopted control strategies, will be less than or equal to 436 tpsd. In addition, the plan must also account for growth; this will be described in the next section.

6. The 1999 Projected Inventory, Uncontrolled

The CAA requires that ozone nonattainment areas classified as serious and above achieve a nine percent reduction in VOC emissions between 1996 and 1999. The reduction must be achieved from anthropogenic VOC emission levels reported in the state's 1990 Base Year Inventory after those levels have been adjusted downward to remove emission reductions achieved by the pre-1990 FMVCP and the use of 9.0 RVP gasoline. The nine percent reduction plan must also offset the expected growth in VOC emissions between 1996 and 1999. As a result, the total reduction necessary from 1996 actual emissions is greater than nine percent. The Base Year Inventory is discussed in Section 4. This section presents the 1999 Projection Year Inventory, which is DEP's estimation of the level of VOC emissions expected in 1999, assuming no <u>new</u> additional regulatory strategies are implemented.

6.1 Growth Factor Methodology

The Projected Year Inventory is developed by applying growth factors to the Base Year Inventory. Guidance from the EPA suggests four typical indicators of growth. In order of priority, these are:

1. Product output
2. Value added
3. Earnings
4. Employment

Surrogate indicators of activity developed by a state, such as population, may also be acceptable methods. The Bureau of Economic Analysis (BEA) provided projections of income, employment, and population from which appropriate growth factors were derived.

The BEA provides state specific historical data for 1973, 1979, 1983, and 1988 and projection estimations for 1995, 2000, 2005, 2010, and 2040 for each indicator it considers. 1973 and 1979 were not included in the analysis because the economic changes in Pennsylvania in those years create a nonlinear growth rate. Data for 2010 and 2040 were also excluded because of a lack of confidence in the projections.

Since the BEA did not provide data for 1990 and 1999, these numbers are calculated by assuming a linear growth rate between the two closest years where data exists (i.e. 1988, 1995, & 2000). For example, 1990 values are derived using the following formula:

$$IND90 = IND88 + (\frac{2}{7} \times (IND95 - IND88))$$

where:

IND*??* = BEA value for the chosen category for the year *??*

The data were then reviewed in comparison to the 1983, 2000, and 2005 data to verify that the assumption of linear growth was valid.

6.2 Point Source Emissions Growth Calculation

Growth in the point source inventory was calculated, without exception, based on growth in income. The BEA projects growth in 57 industrial groups which can, for the most part, be matched to a two-digit Standard Industrial Classification (SIC) code.

The above equation was applied to generate 1990 and 1999 values. The resulting growth factors are listed in *Table 9*. *Table 10* is a summary of the 1999 Projected Point Source Inventory with no new controls applied.

Table 9 – Point Source Growth Factors by SIC Code

2-Digit SIC Code	Source Description	Growth Factor	2-Digit SIC Code	Source Description	Growth Factor
01	Agricultural Production-crops	1.054	45	Transportation By Air	1.193
02	Agricultural Production-livestock & Animal Special	1.054	46	Pipelines, Except Natural Gas	1.042
07	Agricultural Services	1.168	47	Transportation Services	1.175
08	Forestry	1.168	48	Communications	1.082
09	Fishing, Hunting And Trapping	1.168	49	Electric, Gas And Sanitary Services	1.115
10	Metal Mining	0.981	50	Wholesale Trade-durable Goods	1.083
12	Coal Mining	0.981	51	Wholesale Trade-nondurable Goods	1.083
13	Oil And Gas Extraction	0.994	52	Building Materials, Hardware, Garden Supply	1.099
14	Mining And Quarrying Of Nonmetallic Minerals	1.087	53	General Merchandise Stores	1.099
15	Building Construction-general Contractors & Bldrs	1.066	54	Food Stores	1.099
16	Heavy Construction Other Than Bldg Constr-contract	1.066	55	Automotive Dealers And Gasoline Service Stations	1.099
17	Construction-special Trade Contractors	1.066	56	Apparel And Accessory Stores	1.099
20	Food And Kindred Products	1.027	57	Home Furniture, Furnishings & Equipment Stores	1.099
21	Tobacco Products	0.871	58	Eating And Drinking Places	1.099
22	Textile Mill Products	1.006	59	Miscellaneous Retail	1.099
23	Apparel & Other Finished Products Made From Fabric	0.962	60	Depository Institutions	1.107
24	Lumber & Wood Products, Except Furniture	1.138	61	Nondepository Credit Institutions	1.107
25	Furniture And Fixtures	1.110	62	Security & Commodity Brokers, Dealers, Exchanges	1.093
26	Paper And Allied Products	1.078	63	Insurance Carriers	1.136
27	Printing, Publishing And Allied Industries	1.107	64	Insurance Agents, Brokers And Service	1.136
28	Chemicals And Allied Products	1.047	65	Real Estate	1.243
29	Petroleum Refining And Related Industries	1.002	67	Holding And Other Investment Offices	1.093
30	Rubber And Miscellaneous Plastics Products	1.119	70	Hotels, Rooming Houses, Camps, etc.	1.149
31	Leather And Leather Products	0.978	72	Personal Services	1.088
32	Stone, Clay, Glass And Concrete Products	1.021	73	Business Services	1.293
33	Primary Metal Industries	0.922	75	Automotive Repair, Services & Parking	1.145
34	Fabricated Metal Products, Except Machinery & Tran	1.072	76	Miscellaneous Repair Services	1.293
35	Industrial And Commercial Machinery & Computer Equipment	1.029	78	Motion Pictures	1.164
36	Electronic & Other Electrical Equipment & Componen	0.979	79	Amusement And Recreation Services	1.164
37	Transportation Equipment	1.050	80	Health Services	1.187
38	Measuring, Analyzing & Controlling Instruments	1.070	81	Legal Services	1.240
42	Motor Freight Transportation And Warehousing	1.079	82	Educational Services	1.102
44	Water Transportation	0.944	89	Services Not Elsewhere Classified	1.139

Source: BEA Regional Projections to 2040, U.S. Dept. of Commerce, June 1990

Table10 – 1999 Projected Point Source Emissions Inventory – Uncontrolled (in tpsd)

VOC INVENTORY						
Category	**Bucks**	**Chester**	**Delaware**	**Montgomery**	**Philadelphia**	**Total**
Storage, Transport, Marketing	0.01	0.09	14.06	0.41	7.20	
Industrial Processes	1.60	1.33	17.17	3.81	18.37	
Industrial Surface Coating	20.81	7.00	34.62	1.94	10.40	
Other Solvent Use	1.65	8.93	3.24	1.97	1.56	
Waste Disposal	0.00	0.00	0.02	0.01	0.00	
Misc. Sources	0.47	1.38	1.61	0.45	2.39	
TOTAL:	**24.54**	**18.73**	**70.72**	**8.59**	**39.92**	**162.50**
NO_x INVENTORY						
Category	**Bucks**	**Chester**	**Delaware**	**Montgomery**	**Philadelphia**	**Total**
External Fuel Combustion	3.09	13.36	49.55	5.61	32.89	
Stationary Internal Combustion	5.56	15.97	3.17	0.64	3.14	
Other Combustion	0.00	0.01	0.02	0.04	0.36	
Industrial Processes	7.00	1.72	19.69	1.84	13.82	
TOTAL:	**15.66**	**31.06**	**72.43**	**8.13**	**50.21**	177.49

6.3 Area Source Emissions Growth Calculation

With the exception of gasoline marketing operations, the area source inventory was projected based on BEA data. In most cases, the factors used were those of employment or population growth. Although guidance from EPA suggested that population or employment alone were not necessarily adequate indicators of emissions growth in comparison to income or value added growth, since population and employment factors were the factors used to develop the emissions inventory, DEP believes they are the most appropriate factors to project growth.

The area source inventory is based primarily on employment and population emission factors. Emissions are calculated using a factor of a given number of pounds of pollutant per employee or per person. As this is the EPA approved method for calculating emissions to determine the Base Year Inventory, consistency dictates their use, where available, in projected year inventories. Other areas, such as air transport, where emissions are based on a measurable activity level, were considered on an individual basis and the best available factor was selected. See *Table 11* for a comparison of activity indicators and growth indicators for area sources. The resulting growth factors, after applying the equation given in the Growth Factor Methodology section above, are detailed in *Table 12*. These factors were used to project the 1999 uncontrolled emissions shown in *Table 13*.

Table 11 – Area Source Activity and Growth Indicators

Source Category	Activity Indicator	Indicator of Growth	Source Category	Activity Indicator	Indicator of Growth
Industrial Processes			**Combustion**		
Surface Coating:			FUEL OIL COMB	Fuel Consumption	Population
AUTO REFINISH	Employment	Population	COAL CON (RES)	Fuel Consumption	Population
TRAFFIC LINE P	Population	Population	NAT'L GAS & LPG	Fuel Consumption	Population
FACTORY FI WOOD	Employment	Durable Mfg. Employment	STRUCTURE FIRE	Number of Fires	No Growth Projected
METAL FURN & FIX	Employment	Durable Mfg. Employment	FOREST FIRES	Number of Fires	No Growth Projected
ARCHITECT	Population	Population	ORCHARD HEAT	Population	Population
ELECT INS	Employment	Durable Mfg. Employment			
METAL CANS	Employment	Fabricated Metal Employment.	**Gasoline Marketing**		
MISC FI METALS	Employment	Fabricated Metal Employment.	VOC-NO STAGE I	Fuel Sales	VMT
MACH & EQUIP	Employment	Nonelectric Machine Mfg. Emp.	STAGE I	Fuel Sales	VMT
APPLIANCES	Employment	Electric Machine Mfg. Employment	STAGE II	Fuel Sales	VMT
MOTOR VEH	Employment	Motor Vehicle Employment	TANK BREATH	Fuel Sales	VMT
OTHER TRANS	Employment	Transportation Employment	AIRCRAFT REFUEL	Fuel Sales	Air Transport Employment
MARINE	Employment	Durable Mfg. Employment			
MISC MANU	Employment	Durable Mfg. Employment	**Waste Disposal**		
HIGH PERF	Population	Durable Mfg. Employment	SOLID WASTE LF	Throughput	Population
OTHER SPEC COAT	Population	Durable Mfg. Employment	POTW	Throughput	Population
			OPEN BURNING	Throughput	Population
Other Industrial:			SOLID WASTE INC	Throughput	Population
PESTICIDES	Land area	Farm Employment			
BIOPROCESS	Production	Population	**Misc. Evaporative**		
GRAPHIC ARTS	Population	Printing & Publishing Employment	ASPHALT	Population	Population
OFFSHORE	Population	No Growth Projected	LUST	Number of Tanks	Population
DEGREASING	Employment	Durable Mfg. Employment	CATASTROPHIC	Individual Records	No Growth Projected
Consumer/ Commercial					
DRY CLEANING	Population	Population			
COMM/CONSUM	Population	Population			

Table 12 – Pennsylvania Area Source Growth Factors

										'90-99
Category	**1983**	**1988**	**1990**	**1995**	**1996**	**1999**	**2000**	**2002**	**2005**	**Growth**
Air Trans. Emp.	11.2	16.4	17.4	19.9	20.3	21.3	21.7	22.1	22.8	**1.226**
Auto Repair Emp.	49.8	65.4	67.6	73.2	74.2	77.0	78.0	79.3	81.2	**1.139**
Chemical Mfg. Emp.	58.1	60.1	59.8	59.2	59.2	59.1	59.1	58.8	58.4	**0.988**
Construction Emp.	233.9	319.2	323.1	332.9	334.8	340.4	342.3	344.0	346.5	**1.054**
Durable Mfg. Emp.	637.6	621.7	615.2	598.9	596.8	590.7	588.6	584.0	577.1	**0.960**
Electric Mach. Emp.	106.7	94.3	91.4	84.3	83.3	80.3	79.3	77.8	75.6	**0.878**
Fabricated Metal Emp.	87.9	94.9	95.5	97.1	97.3	97.7	97.9	97.5	96.9	**1.023**
Farm Employment	95.1	90.1	89.1	86.6	86.2	85.0	84.6	83.6	82.2	**0.954**
Food Mfg. Emp.	91.0	91.9	91.6	90.8	90.7	90.4	90.3	89.5	88.4	**0.987**
Furniture Employment	19.4	22.5	22.9	24.0	24.2	24.9	25.1	25.4	25.8	**1.085**
Lumber Prod. Emp.	22.5	35.3	36.4	39.1	39.6	41.0	41.5	42.1	43.0	**1.127**
Motor Vehicle Emp.	24.6	25.1	24.8	24.2	24.1	23.7	23.6	23.4	23.0	**0.955**
Nondurable Mfg. Emp.	480.6	460.5	458.2	452.5	452.3	451.7	451.5	449.1	445.4	**0.986**
Nonelectric Mach. Emp.	109.3	109.4	108.4	105.9	105.4	104.1	103.6	102.9	101.9	**0.960**
Petroleum Prod. Emp.	14.9	10.5	10.4	10.0	10.0	9.8	9.8	9.7	9.5	**0.950**
Primary Metal Emp.	121.0	91.3	87.5	78.0	76.8	73.2	72.0	70.0	67.0	**0.837**
Printing & Publish. Emp.	75.1	87.7	89.3	93.4	94.1	96.3	97.0	97.8	99.1	**1.078**
Railroad Employment	22.7	18.3	17.4	15.3	15.1	14.4	14.2	13.8	13.3	**0.827**
Retail Trade Emp.	910	1038	1056	1100	1110	1138	1148	1158	1174	**1.078**
Total Pop. (in Thou.)	11895	12001	12091	12316	12356	12475	12515	12597	12719	**1.032**
Transportation Emp.	35.8	37.3	37.1	36.6	36.6	36.5	36.5	36.3	36.1	**0.984**
Water Trans. Emp.	7.1	5.1	5.0	4.6	4.6	4.4	4.4	4.3	4.2	**0.896**
Wholesale Trade Emp.	254.7	286.4	291.5	304.4	306.4	312.2	314.2	317.1	321.4	**1.071**

Table 13 – 1999 Projected Area Source Emissions Inventory – Uncontrolled (in tpsd)

VOC INVENTORY						
Category	**Bucks**	**Chester**	**Delaware**	**Montgomery**	**Philadelphia**	**Total**
Transportation	0.20	0.08	6.08	1.62	1.83	
Industrial Processes	16.72	9.59	12.44	26.54	36.05	
Combustion	0.11	0.07	0.14	0.18	0.45	
Gasoline Marketing	5.80	4.58	3.74	7.60	7.44	
Waste Disposal	0.89	1.66	1.09	9.58	9.51	
Consumer/Commercial	5.48	4.32	5.19	6.63	14.96	
Misc. Evaporative	0.33	0.24	0.34	0.42	0.97	
TOTAL:	**29.52**	**20.55**	**29.01**	**52.57**	**71.21**	**202.86**
NO_x INVENTORY						
	Bucks	**Chester**	**Delaware**	**Montgomery**	**Philadelphia**	**Total**
TOTAL:	5.08	2.80	7.43	8.99	22.71	**47.01**

6.4 Nonroad Engine Emissions Growth Calculation

Growth in emissions from nonroad engines was calculated using the same methodology used for the area sources. *Table 14* compares the activity level indicators used by the EPA with the growth indicators used here for projection. *Table15* details the projected uncontrolled 1999 emissions.

Table 14 – Comparison of Activity Level Indicators vs. Growth Indicators for Nonroad Engines

Category	Activity Indicator	Growth Indicator	'90-'99 Growth Factor
Lawn and Garden Equipment	Single Family Homes and Landscaping Emp.	Population	1.032
Airport Service Equipment	Aircraft Operations	Employment	1.226
Recreational Equipment	Establishments in SIC 557 (Motorcycle Dealers)	Population	1.032
Recreational Marine Equipment	Boat Registration and Water Area	Population	1.032
Light Commercial Equipment	Wholesale Trade Establishments	Employment	0.986
Industrial Equipment	Employment	Employment	0.96
Construction Equipment	Employment	Employment	1.054
Agricultural Equipment	Employment	Employment	0.96
Logging Equipment	Logging Establishments	Employment	1.127

Table 15 – 1999 Projected Nonroad Engine Emissions Inventory – Uncontrolled (in tpsd)

VOC INVENTORY						
Category	**Bucks**	**Chester**	**Delaware**	**Montgomery**	**Philadelphia**	**Total**
Agricultural Equipment	0.56	0.81	0.05	0.41	0.01	
Construction Equipment	1.45	1.10	1.27	2.62	2.38	
Airport Service Equipment	0.00	0.00	0.00	0.00	1.03	
Industrial Equipment	1.49	1.09	1.14	2.77	2.75	
Lawn & Garden Equipment	8.40	6.64	6.78	12.02	14.55	
Recreational Vehicles	0.44	0.56	0.00	0.00	0.00	
Recreational Vessels	3.19	4.10	1.15	2.44	1.43	
TOTAL:	**15.54**	**14.30**	**10.39**	**20.25**	**22.15**	**82.63**
NOx INVENTORY						
	Bucks	**Chester**	**Delaware**	**Montgomery**	**Philadelphia**	**Total**
TOTAL:	**13.40**	**11.43**	**9.59**	**21.36**	**18.59**	**74.37**

6.5 Highway Vehicle Emissions Growth Calculation

Highway vehicle emissions growth and, in the area source category, gasoline marketing growth, are projected based on the projected increase in VMT. These projections are developed using a fairly complex procedure comprised of a combination of estimations, trend analyses, and models. The process is summarized below.

The emission calculation process used for Pennsylvania is summarized in the following diagram, where

VMT is vehicle miles of travel

RMS is roadway management system - a facility to store and maintain information related to each highway segment (link). The types of data stored in RMS include: administrative, traffic, pavement structure, pavement condition, highway performance monitoring system.

HPMS is highway performance monitoring system - a subsystem of the RMS established to meet the data reporting requirements of the Federal Highway Administration (FHWA) and to serve as PennDOT's official source of highway information. Like the RMS, the HPMS is a data storage and maintenance facility and contains additional information required by the FHWA.

PPAQ is Post Processor for Air Quality - provides a flexible linkage between network-based transportation demand forecasting systems and EPA's MOBILE model. Using a standard highway planning network or database as a starting point, the PPAQ system provides all the tools necessary to analyze the network, to drive MOBILE efficiently, and to display and evaluate the results of MOBILE runs.

Roadway Data Source Used for Analysis		**Growth Method to Future years**		**Method to Calculate VMT & Speeds**		**Method to Calculate Emissions**
PennDOT RMS data for each county	⇨	Use historic HPMS VMT growth trends	⇨	PPAQ	⇨	MOBILE Model

Roadway Data Sources Used for Analysis: The emissions calculation process used by PennDOT involves the use of databases or microcomputer-based travel demand models, both of which represent the existing and future highway systems. The roadway data source is based on an adaptation of the RMS state highway database maintained by PennDOT. This database is downloaded to microcomputers and enhanced to provide additional data needed for VMT and speed determinations. The database contains all state highways, arterials, collectors, and locals; however, it does not contain facilities under local jurisdiction. Transit networks are not explicitly modeled.

Travel Estimation Procedure: For purposes of projecting emissions to be used in ROP SIPs, growth factors are used to project future highway volumes. Separate factors are derived for each county and highway functional class from an analysis of historic HPMS traffic growth trends, coupled with estimates of population and employment growth from the Bureau of Economic Analysis (BEA). The factors are then applied to base year traffic volumes on each highway link in the RMS network database to produce future volumes.

Estimation of Traffic Flow Variables: For purposes of the ROP SIP, PPAQ software is used to compile and compute traffic flow variables, control the MOBILE run, and produce summary emission reports. The traffic flow variables include VMT, vehicle type distributions, and speeds. VMT are calculated from traffic volumes and link or segment distances. Base year (1990) VMT is reconciled with totals compiled from the HPMS, and adjustments are carried forward into future scenarios. Further adjustments are applied to produce VMT estimates which represent July weekday conditions (a typical summer day). Traffic speeds are calculated using complex algorithms based upon the 1994 Highway Capacity Manual plus additional algorithms for specialized conditions. Speeds are separately calculated for each highway segment or link, and for each hour of the day. In addition to the estimate traffic volumes, these speed calculations are based upon a variety of physical characteristics including functional class, area (urban/rural), number of lanes, and the number of traffic signals. Vehicle type distributions are compiled and adjusted to match recorded and estimated truck volumes on each highway segment or link.

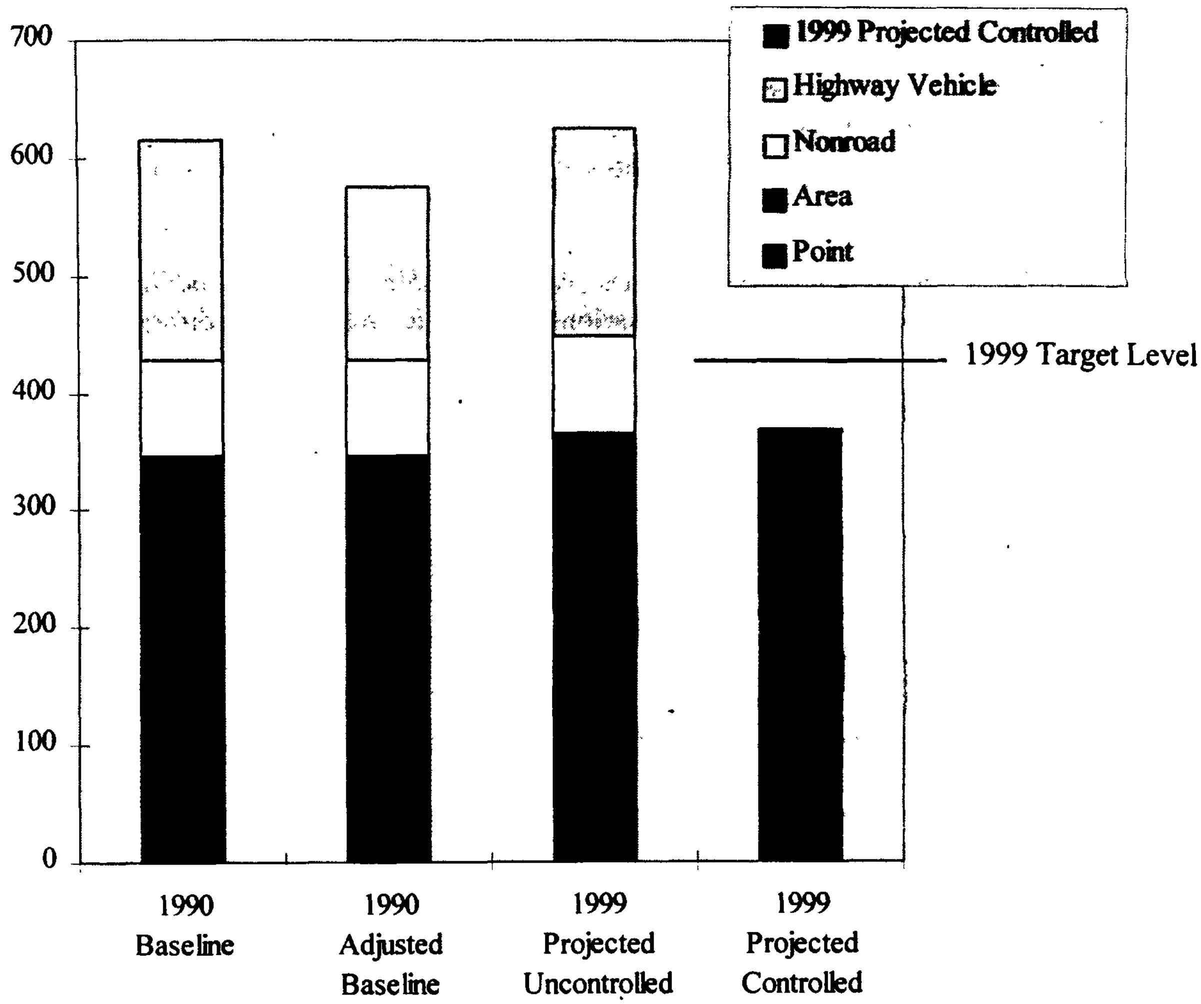
Estimation of Mobile Source Emissions: Estimates of VOC and NOx emissions are based upon EPA's MOBILE program, which calculates emission factors for future years. Inputs to the MOBILE program include traffic flow characteristics (as determined from PPAQ), vehicle descriptions, fuel parameters, inspection/maintenance program parameters, and environmental variables. VOC and NOx emissions are calculated for each county, functional class, and time period scenario using all of the above input variables. MOBILE produces emission factors (grams of pollutant per vehicle mile) which are multiplied by vehicle miles of travel to produce the pollutant quantity.

Table 16 shows the projected uncontrolled 1999 emissions inventory projected using Mobile 5a_h and based on the methodology described above and in sections 3.3.4 (Highway Vehicle Sources) and 3.3.5 (VMT Estimation Procedure) in the April 10, 1997 version of the 15% ROP Plan.

Table 16 – 1999 Projected Highway Vehicle Emissions Inventory – Uncontrolled (in tpsd)

VOC INVENTORY						
Category	**Bucks**	**Chester**	**Delaware**	**Montgomery**	**Philadelphia**	**Total**
LDGV	30.94	19.45	20.70	35.54	47.35	
LDGT1	1.27	1.02	0.84	1.62	1.96	
LDGT2	1.00	0.80	0.62	1.22	1.41	
HDGV	0.31	0.24	0.21	0.36	0.43	
LDDV	0.31	0.21	0.22	0.38	0.47	
LDDT	0.03	0.03	0.02	0.05	0.05	
HDDT	0.22	0.18	0.16	0.30	0.31	
MC	1.34	1.08	0.91	1.73	1.60	
TOTAL:	**35.42**	**23.00**	**23.67**	**41.19**	**53.58**	**176.86**
NO_x INVENTORY						
	Bucks	**Chester**	**Delaware**	**Montgomery**	**Philadelphia**	**Total**
LDGV	26.09	21.51	15.93	31.59	31.67	
LDGT1	1.38	1.36	0.82	1.71	1.76	
LDGT2	1.01	1.00	0.58	1.24	1.24	
HDGV	0.42	0.42	0.26	0.53	0.50	
LDDV	0.92	0.75	0.56	1.12	1.12	
LDDT	0.09	0.09	0.06	0.12	0.13	
HDDT	1.84	1.85	1.14	2.35	2.21	
MC	0.22	0.19	0.13	0.26	0.20	
TOTAL:	**31.96**	**27.18**	**19.49**	**38.91**	**38.82**	**156.38**

Chart 11 – VOC Inventory Summary with 1999 Target Level



NOTE: 1999 Projected Controlled Inventory bar includes both VOC and VOC-equivalent (from NO_x) reductions.

6.6 Accounting For Growth In Emissions

Due to many factors – such as population increase, increases in spending and industrial production, increases in the number of miles people drive every year, and other factors – emissions would grow continually if left unchecked. This anticipated growth in emissions must be offset by various control measures in order for an area to meet its air quality goals.

The 1999 target level of emissions (shown in *Table 3* and described in Section 5) is 436 tpsd. Projected uncontrolled emissions for 1999 are 625 tpsd – a difference of 189 tpsd that must be reduced. The 1999 target level includes not only the reductions necessary to meet the rate of progress requirement, but also the reductions planned to offset growth between 1990 (the base year) and 1999.

Demonstrated in *Table 17* below, total net growth in emissions from 1990 through 1999 is ten tpsd – which means that without additional control measures, emissions as a whole grow ten tpsd due to the factors described in the growth methodology discussion in the previous section. The individual inventories for point, area, and nonroad sources experience positive growth, but emissions from highway vehicles are reduced without additional control measures between 1990 and 1999. The reason for this is that growth in highway vehicle emissions due to vehicle miles traveled emissions is completely compensated for by the Federal Motor Vehicle Control Program (FMVCP) and the nationwide use of lower volatility gasoline (vapor pressure of 9.0 psi). The FMVCP, in place prior to the passage of the 1990 CAA, which results in emission reductions due to newer, cleaner cars replacing older, less efficient vehicles in the general vehicle population, cannot be claimed as part of the required nine percent reduction. This is also true for the emission reductions due to the federal low volatility gasoline program. Between 1990 and 1999, FMVCP and low volatility gasoline will result in emission reductions of 39 tpsd. Therefore, the total projected growth (of all four emission categories) is 10 tpsd. This is the net growth you see in the shaded column in Table 17, below.

Another way to describe this is the idea that the "uncontrolled" emission inventory for highway vehicles is not uncontrolled in the true sense of the word. Reductions due to fleet turnover (the introduction of newer, cleaner cars into the fleet and the corresponding replacement of older, less efficient cars) are included in the uncontrolled inventory. The uncontrolled inventory does not include the application of any *new* programs implemented after 1990 (i.e. reformulated gasoline and I/M) – these programs are incorporated only in the controlled inventory. As stated above, the technology introduced in new cars has been advanced enough to offset the increases in emissions due to increase in VMT. As VMT continues to increase and more cars are introduced into the fleet, this "negative growth" may not continue.

Emission reductions from FMVCP and low volatility gasoline are not creditable toward the ROP required reduction of 52 tpsd; therefore, other reductions in emissions from highway vehicles are necessary. These are described in the 1999 controlled inventory section.

Table 17 – Growth in VOC Emissions, 1990-1999 (all values in tons per summer day)

Emission Category	1990 Baseline *tpsd*	1999 FMVCP/ RVP *tpsd*	1990 Adjusted Baseline *tpsd*	9% Reduction *tpsd*	'90-'99 Growth *tpsd*	1999 Projected Uncontrolled *tpsd*
Point	153		153		10	163
Area	194		194		9	203
Nonroad	81		81		2	83
Highway Vehicle	188	39	148		-11	177
TOTAL	**616**	**39**	**576**	**52**	**10**	**625**

NOTE: The total shown in the '90-'99 growth column is the difference between the 1990 Base Year (unadjusted) inventory and the 1999 Projected Uncontrolled inventory.

7. The Rate of Progress Plan

7.1 Summary

In section five, the 1999 target level of emissions was established to be 436 tpsd. If emissions were allowed to grow uncontrolled from 1990 through 1999, the 1999 VOC inventory would be about 625 tpsd. Therefore, a total of 189 tpsd must be reduced to meet the 1999 target level. To meet this requirement Pennsylvania expects to achieve emissions reductions of 256 tpsd (146 tpsd from VOC controls, and 110 tpsd of VOC-equivalent reductions from NO_x controls) from a variety of strategies. These measures can be classified as federally-mandated measures, pending federal programs, or state and local initiatives. In addition, contingency measures are planned that will lead to 18 tpsd of VOC reductions and NO_x reductions equivalent to 2 tpsd of VOC.

Federally-mandated measures are control programs that were clearly mandated by the Clean Air Act. These measures make up the majority of the necessary emissions reductions. *Table 18* summarizes these measures and the VOC and NO_x reductions expected.

Pending federal programs and state and local initiatives are also critical to achieving the 1999 target. The expected reductions from these programs are also included in *Table 18*.

The CAA[3] allows post-1996 reductions in NO_x to be substituted for a portion of the required VOC reductions. Between 1996 and 1999, 81 tpsd of NO_x reductions will be achieved and are eligible to contribute to the total ROP reductions. All reductions must be reported in tons of VOCs, so the NO_x reductions must be converted to "VOC-equivalent" tons. Following EPA guidance[4] and the calculation on the next page, one ton of NO_x is "worth" 1.37 tons of VOC; therefore, the 81 tpsd of NO_x reductions are worth 110 tpsd of VOC reductions. In addition, approximately 2 tpsd of NO_x reductions from source and process shutdowns – worth approximately 2 tpsd of VOC-equivalent reductions for a total of 112 VOC-equivalent reductions from NO_x controls –will be applied toward the contingency measures requirement. Expected NO_x reductions are summarized in *Table 18*.

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[3] 42 U.S.C. §7511a(c)(2)(C).

[4] "NO_x Substitution Guidance" December, 1993, US EPA Office of Air Quality Planning and Standards.

To convert the NOx reduction to a creditable VOC reduction the following formula is used:

$$R_{VOC} = VOCbase \times \left(\frac{R_{NOx}}{NOxbase} \right)$$

$$R_{VOC} = 576 \text{ tpsd} \times \left({}^{82 \text{ tpsd}}\!/_{420 \text{ tpsd}} \right)$$

$$R_{VOC} = 112 \text{ tpsd}$$

where:

R_{VOC} = Reduction in VOC
R_{NOx} = Reduction in NO_x
VOC_{base} = 1999 Adjusted Baseline VOC emissions
NO_xbase = 1999 Adjusted Baseline NO_x emissions

** Total equivalent VOC reduction is 112 tpsd.

Table 18 – Expected VOC and NO_x Reductions

PROGRAM	Expected Reduction tpsd VOC	NO_x	*VOC-equivalent reductions from NOx*
Contributes to 9% ROP			
[redacted]			1
[redacted]			44
[redacted]			20
[redacted]			37
[redacted]			8
[redacted]			0
[redacted]			0
[redacted]			0
[redacted]			0
[redacted]			0
Total ROP Reductions	**146**	**81**	**110**
Contingency Measures			
Rule Effectiveness 80-90%	16	0	0
Shutdowns	2	1	2
Total Contingency Measures	**18**	**1**	**2**
Total All Reductions	**164**	**82**	**112**

Total ROP Reductions: 146 tpsd VOC + (81 tpsd NO_x x 1.37) = 256 tpsd VOC
Total All Reductions: 164 tpsd VOC + 112 tpsd VOC-equivalent = 276 tpsd VOC
(NOTE: All values are rounded to the nearest ton; therefore some discrepancies may exist.)

7.2 Control Measures and Activities

This section provides a detailed description of the control measures and activities Pennsylvania will use to meet the nine percent Rate of Progress requirement.

7.2.1 Point Source Controls

7.2.1.1 NO_x Allowance Program (The NO_x MOU)

Background:

NO_x from large fossil-fuel fired combustion units is a major contributor to regional ozone pollution. The Ozone Transport Commission (OTC) member states, including Pennsylvania, proposed development of a regional approach to address NO_x emissions. Beginning in 1993, the Northeast States for Coordinated Air Use Management (NESCAUM), the Mid-Atlantic Regional Air Management Association (MARAMA), and EPA began working with the OTC to study the feasibility of implementing regional NO_x emission reductions using an emission budget program throughout the northeast. Regional airshed modeling was used to identify the appropriate level of emission reductions that would contribute to a significant improvement in air quality.

As a result of these evaluations, the OTC proposed two additional phases of NO_x emissions reduction beyond that already achieved by the Reasonably Available Control Technology (RACT) program. This recommendation was formally adopted by the OTC in a Memorandum of Understanding (OTC MOU) in September of 1994. The OTC states, in the MOU of September 27, 1994, agreed to propose regulations for the control of NO_x emissions in accordance with the following guidelines:

1. the level of NO_x required would be established from a 1990 baseline emissions level;

2. the reduction would vary by location, or zone, and would be implemented in two phases utilizing a region-wide trading program; and

3. the reduction would be determined based on the less stringent of the following:

    a. By May 1, 1999, the affected facilities in the inner zone shall reduce their combined rate of NO_x emissions by 65%, or emit NO_x at a rate no greater than 0.20 pounds per million BTUs;

b. By May 1, 1999, the affected facilities in the outer zone shall reduce the combined rate of NO_x emissions by 55% from baseline, or shall emit NO_x at a rate no greater than 0.20 pounds per million Btu;

c. By May 1, 2003, the affected facilities in the inner and outer zones shall reduce their combined rate of NO_x emissions by 75% from baseline, or shall emit NO_x at a rate no greater than 0.15 pounds per million Btu; and

d. By May 1, 2003, the affected facilities in the northern zone shall reduce their combined rate of NO_x emissions by 55% from baseline, or shall emit NO_x at a rate no greater than 0.20 pounds per million Btu.

In Pennsylvania, the counties of Berks, Bucks, Chester, Delaware, Montgomery and Philadelphia are in the inner zone; the remaining counties in Pennsylvania are in the outer zone.

In order to ensure that OTC states included common elements in the rules implementing the OTC MOU, the states worked through NESCAUM, MARAMA, and EPA to develop a model rule containing the common program elements. In addition to the state and federal representatives, the NESCAUM/MARAMA NO_x budget task force was joined by an ad hoc committee comprised of representatives from industry, utilities, and environmental groups to ensure broad-based participation and consensus in the model rule.

The task force and ad hoc committee recognized that state program consistency is critical to the overall success of the NO_x allowance program. State programs that are substantively identical in key areas will ensure that a ton of emissions reduced in one state is equivalent to a ton reduced in another state. Since states desire to promote cost effective compliance through intrastate and interstate emission trading, this level of consistency is essential to an effective trading program. The NESCAUM/MARAMA Model Rule meets these objectives and represents substantial consensus among the state and federal governmental representatives and the ad hoc committee members on key regulatory elements of a NO_x allowance program to implement the OTC MOU. The Model Rule applies to fossil-fuel fired combustion units with rated capacity of 250 MMBtu/hour or more and electric generating facilities of 15 megawatts or greater. Under this program, the OTC MOU emission reductions are applied to a 1990 baseline for NO_x emissions in the Ozone Transport Region to create a "cap" on the emissions budget for the two target years: 1999 and 2003. The 1990 baseline was established through extensive work of the OTC, EPA, and industry to refine and quality assure the data available on actual NO_x emissions for 1990. The 1990 emissions and budget for the OTC region has been desegregated to a state level and the states are allocating allowances to the facilities in the program. Beginning in 1999, the sum of NO_x emissions from affected sources during the May 1 through September 30 control period cannot exceed the equivalent number of allowances allocated in the region. An allowance is equal to one ton of NO_x emissions. NO_x-affected sources must hold allowances for all NO_x emitted during the ozone season months of May through September, and NO_x-affected sources are allowed to buy, sell or trade allowances as needed.

The Department worked closely with the affected sources and the Air Quality Technical Advisory Committee to develop the state regulations and specific allocations.

Implementation:

The final regulations were published on November 1, 1997, in the Pennsylvania Bulletin. Affected sources are required to submit monitoring plans and begin monitoring during 1998. Compliance with the emission reduction requirements is required by May 1, 1999. Tracking of emissions will be done at a central location by the Environmental Protection Agency, Acid Rain Division for all states in the OTC. The Department is responsible for enforcement of the control program.

Pennsylvania, by signing the NO_x MOU and promulgating the implementing regulation, is fully committed to Phase II NO_x controls. In accordance with the provisions of the Phase II regulation and MOU, Pennsylvania will commit to determine if the 75% NO_x controls required by Phase III are necessary.

Target Reductions:

The NO_x MOU program affects fourteen facilities in the Pennsylvania counties of the Philadelphia Interstate Ozone Nonattainment Area. *Table 19* lists the affected facilities and their emissions. The anticipated NO_x emission reductions from this program is 27 tons per summer day. (37 tpsd in VOC-equivalent tons)

Note: The data included in Table 19 is for planning purposes only. Table 19 does not place new compliance requirements on sources. The sources must comply with the NO_x MOU regulations as contained in Chapter 123 and their permit conditions.

The planning inventory is based on a typical summer ozone day; it contains estimates of growth and control efficiency. The NO_x MOU regulation established total emissions for a five moth period (May 1 through September 30). It shows a controlled emissions level and does not include growth. As a result of these differences, the planning and NO_x MOU inventories are not compatible.

Table 19 – NO_x MOU Facilities

Company	County	1999 Reductions - tpsd
PECO Energy - Croyden	Bucks	0.40
US Steel Corp.	Bucks	** 0.40
PECO Energy - Cromby	Chester	4.10
PECO Energy - Eddystone	Delaware	14.45
Kimberly-Clark	Delaware	0.08
Sun Refining & Marketing	Delaware	1.17
BP Oil, Inc.	Delaware	3.61
Merck, Sharp & Dohme	Montgomery	** 0.06
PECO Energy - Delaware	Philadelphia	** 0.81
Philadelphia Thermal - Sansom	Philadelphia	0.20
PECO Energy	Philadelphia	** 0.27
PECO Energy - Schuylkill	Philadelphia	1.95
Philadelphia Thermal - Schuylkill	Philadelphia	2.95
Grays Ferry	Philadelphia	0.00
US Navy Base	Philadelphia	0.00
TOTAL REDUCTIONS:		**27.37**

*** These companies are predicted by the BEA growth factors to have increased emissions; therefore, these three numbers are actually emission increases, and are subtracted from the total reductions.*

7.2.1.2 Reasonably Available Control Technology (RACT)

Background:

The CAA requires states to adopt regulatory programs mandating that major stationary sources of VOCs and NO_x located in ozone nonattainment areas implement RACT control strategies. These RACT control efforts were to be completed by the affected sources as "expeditiously as practicable" but no later than May 31, 1996. The RACT requirements apply both to sources affected by the provisions of Control Techniques Guidance (CTG) documents issued by EPA and other major stationary sources. In the Philadelphia ozone nonattainment area, a major stationary source is one that has the "potential to emit" either VOCs or NO_x at a rate equal to or greater than 25 tons per year.

RACT is a generic term which includes the variety of controls which are available for use to reduce emissions from a source or class of sources that are cost effective. EPA has issued CTGs for approximately 25 to 30 classes of sources of VOCs and plans to issue approximately 15 more. The Commonwealth has adopted regulations incorporating the CTG requirements for the classes of sources that are represented in Pennsylvania and has also submitted permits as revisions to the SIP for affected sources. In a series of regulatory revisions in the early 1990's, the Commonwealth made the CAA-mandated RACT fix-ups.

EPA has not issued CTGs to define RACT controls for sources of NO_x and has no plans to do so. However, EPA has issued a number of Available Control Techniques guidance documents for certain classes of NO_x sources. The NO_x guidance documents differ from the VOC CTG documents in that they do not define a presumptive norm for the control requirements, as the CTGs do.

Implementation:

Because of the wide variety and disparate ages of the sources located in the Commonwealth, Pennsylvania has determined that the preferred approach to regulation of major stationary sources of VOC and NO_x for which CTG-based regulations are not in place is through a "case-by-case" RACT regulatory program. The program also includes presumptive RACT for most types of NO_x sources, which operators may elect instead of using the case-by-case approach. Major stationary sources have developed analyses of available technologies for the reduction of the affected pollutants, submitted the analyses to the Department of Environmental Protection for review, approval, or modification, and have implemented approved RACT plans. The case-by-case determinations have been submitted as revisions to the Pennsylvania SIP. For details on the Pennsylvania RACT program, refer to 25 PA. Code §§129.91-129.95.

Target Reductions:

VOC RACT reductions are estimated to be 10 tpsd. NO_x RACT reductions are estimated to be 6 tpsd (8 tpsd of VOC-equivalent reductions). *Table 20,* below, displays the facilities affected by RACT and each facility's associated reduction.

NOTE: Sources included for ROP credit in the NO_x RACT program are only those that are not covered by the NO_x MOU.

Table 20 – VOC and NO_x RACT Facilities

VOC RACT		
Company	**County**	**1999 Reductions - tpsd**
Fasson - Div. of Avery	Bucks	6.54
PECO Energy - Cromby	Chester	0.03
ICI/LNP	Chester	0.27
Norwood Industries	Chester	2.12
Philadelphia Baking	Philadelphia	0.12
Nabisco	Philadelphia	0.33
Continental Baking	Philadelphia	0.41
TOTAL VOC RACT:		**9.82**
NO_x RACT		
Company	**County**	**1999 Reductions - tpsd**
Transcontinental Gas Pipeline	Chester	3.62
PECO Energy - Cromby	Chester	0.01
Sun Refining & Marketing	Delaware	1.99
Philadelphia Baking	Philadelphia	0.01
TOTAL NO_x RACT:		**5.63**

7.2.2 Area Source Controls

7.2.2.1 Architectural and Industrial Maintenance Coatings

Background:

The CAA requires EPA to adopt regulations for certain VOC-containing coatings. The ongoing national regulatory negotiation for Architectural and Industrial Maintenance (AIM) coatings is in the process of defining the final requirement.

AIM coatings are field-applied coatings used by industry, contractors, and home owners to coat houses, buildings, highway surfaces, and industrial equipment for decorative and protective purposes. The different types of coatings include flat, non-flat, and numerous specialty coatings. VOC emissions result from the evaporation of solvents from the coatings during application and drying.

Because the category consists primarily of non-shop-applied coatings, the only technically and economically feasible control strategies involve product reformulation. This can involve one or more of the following approaches:

- Replacing VOC solvents with non-reactive substitutes.

- Increasing the amount of solids.
- Altering the chemistry of the resin so less solvent is needed for the required viscosity.
- Switching to waterborne latex or a water soluble resin system.

Implementation:

This is a pending federal measure.

Target Reductions:

Based upon EPA guidance, an emissions reduction of 15 percent could be applied towards the requirements for the Rate of Progress plan. The reductions were calculated as follows:

$$Reduction = 99proj \times 15\%$$

The projected emissions were summed from the categories of Architectural Coatings, Special Purpose Coatings and High Performance Coating. This resulted in approximately 40 tpsd projection and, from the above equation, creditable VOC reductions of 7 tpsd.

7.2.2.2 Stage II Vapor Recovery

Background:

This control measure involves the installation of Stage II vapor recovery nozzles at gasoline pumps. This will reduce emissions of vapors in the fuel tank that are displaced by incoming gasoline. Additional reductions are gained over time as the federal onboard vapor recovery controls on new vehicles replace older uncontrolled vehicles.

This strategy also includes reductions from the federal Onboard Vapor Recovery Program which requires onboard refueling emissions controls for passenger cars and light trucks. This program will be phased-in over three model years with 40 percent, 80 percent, and 100 percent of new car production being required to meet the standard in model years 1998, 1999, and 2000 respectively.

Implementation:

Implementation of Stage II vapor recovery systems in the five county Philadelphia area was mandated in section 6.7(e) of the Air Pollution Control Act (35 P.S. § 4005(a)(1)). See also 25 Pa. Code §129.82.

Installation of Onboard Vapor Recovery systems is mandated by §202(a)(6) of the Clean Air Act Amendments and by 59 FR 16262, dated April 6,1994.

Uncontrolled emissions for refueling emissions have an emission factor of 11.7 lbs. per 1000 gallons, according to Appendix IV of AP42. This factor was obtained by adding the Stage II emission factor with the spillage emission factor. The Department of Revenue provided fuel sales for 1990 for the Commonwealth of Pennsylvania. The fuel sales were apportioned by county based on the percentage of VMT of the county to the state, projected to the milestone years based on growth in VMT expected by PennDOT.

Table 21 – Fuel Sales By County (in thousand gallons)

COUNTY	1990	1999
Bucks	666	758
Chester	526	598
Delaware	429	488
Montgomery	872	993
Philadelphia	854	972
	3,346	3,809

Mobile 5B was used to determine the emission factor for controlled Stage II. The assumptions were 95% Rule Penetration and 80% Rule Effectiveness. This produces a 76% efficiency which was used as an input along with the start year of 1993 and a phase-in period of 2 years into the Mobile 5B input file of the projected control strategies. In addition, Mobile5B was instructed to include reductions for the onboard vapor recovery systems. This resulted in the emission factor in the below table. For convenience, the emission factor has been converted into pounds per thousand gallons.

	1999
Controlled EF (g/gal)	1.09
Controlled EF (lbs/ 10^3 gal)	2.40

Reductions. The following table summarizes the emission reductions from this plan.

Table 22 – Stage II Reductions

EMISSIONS	1999
Uncontrolled	22.28
Controlled	4.57
Reductions	17.71

The following sample calculation details the process used to determine the 1999 emission reductions. (The result of this calculation may be ± .01 due to rounding.)

Emission Factor Calculation:

$$EF_{no\ Stage\ II} = \frac{11.7 lbs}{1000 gal}$$

$$Efficiency = RE \times RP = .80 \times .95 = 76\%$$

$$EF_{Stage\ II} = 1.09\ {}^{g}\!/_{gal} \times \frac{kg}{1000g} \times 2.205\ {}^{lbs}\!/_{kg} \times {}^{1000gal}\!/_{10^3 gal} = \frac{2.40 lbs}{10^3 gal}$$

Emission Reduction Calculation

$$99Emis_{No\ Stage\ II} = EF_{No\ Stage\ II} \times Gallons\ Sold_{1999\ Daily}$$

$$= 11.7\ {}^{lbs}\!/_{10^3 gal} \times 3{,}809\ 10^3 gal \times \frac{1 ton}{2000 lbs} = 22.28 tons$$

$$99Emis_{Stage\ II} = EF_{Stage\ II} \times Gallons\ Sold_{1999\ Daily}$$

$$= 2.40\ {}^{lbs}\!/_{10^3 gal} \times 3{,}809\ 10^3 gal \times \frac{1 ton}{2000 lbs} = 4.58 tons$$

$$Reductions = 99Emis_{NoStage\ II} - 99Emis_{Stage\ II}$$

$$= 22.28 tons - 4.58 tons = 17.71 tons$$

7.2.2.3 Treatment, Storage, and Disposal Facilities (TSDFs)

Background:

Treatment, storage and disposal facilities (TSDFs) manage hazardous wastes containing VOCs and hazardous air pollutants (HAPs). These facilities manage dilute wastewaters, organic and inorganic sludges, and organic and inorganic solids. The waste disposal is accomplished by incineration, land treatment, underground injection, or landfills.

Implementation:

This is a federally-implemented measure.

Target Reductions:

Phase I standards were promulgated on June 21, 1990. The Phase II standards, promulgated on December 8, 1997 control emissions by 93%. This control level, with an 80% rule effectiveness factor, was used to calculate the 1999 emissions reduction. This program results in VOC reductions of about 10 tpsd.

7.2.2.4 Autobody Refinishing

Background:

EPA is in the process of adopting regulations controlling emissions from coatings used in autobody refinishing.

These coatings are typically shop-applied coatings used by industry, small businesses, and vehicle owners to repair or recondition vehicles. VOC emissions result from the evaporation of solvents from the coatings during the following steps:

- Surface Preparation
- Surface Coating Application
- Cleaning of Application Equipment

There are several methods currently available to reduce emissions. The VOC content of surface preparation products is approximately 6.75 lbs/gal. There are products available with VOC levels below 1.7 lbs/gal. Similar reductions are also feasible from the reformulation of the surface coatings, including sealers and topcoats. High-efficiency transfer spray systems have been shown to reduce emissions by 20-40%. Another technique is to install spray-gun cleaning equipment at body shops – this has been shown to reduce equipment cleaning emissions by 88%, and is already in use in many autobody repair shops.

The pending federal measure targets the surface coatings. These are responsible for approximately 70% of the emissions in this source category.

Implementation:

This is a pending federal measure.

Target Reductions:

Reductions from the reformulation of surface coatings are expected to be at least 37%. Because this rule affects a limited number of manufacturers, RE adjustments are not required.

Projected VOC emissions of 18.34 tpsd were taken from the 1996 uncontrolled area source inventory. When the 37% reduction factor is applied, a 6 tpsd creditable reduction of VOC is achieved.

7.2.2.5 Consumer Products

Background:

The CAA requires EPA to establish regulations controlling emissions from consumer products. These include items sold for household, personal, and automotive use that contain VOCs. There are several definitions of consumer products. For the purpose of the pending federal measure they are considered to be any VOC-containing products in one of the previously mentioned categories, with the exception of aerosol paints.

Although the sources in this category are widely geographically disbursed, there are still several effective alternatives for controlling emissions from this category. These include:

- Product Reformulation
- Use of non-VOC Propellants (including CO_2, compressed air and HFC-152a)
- Use of alternative delivery systems (i.e. handpumps or solids)
- Product Substitution

Implementation:

This is a pending federal measure.

Target Reductions:

Reductions from this measure are expected to be at least 25%. After application of the default rule effectiveness factor, a 20% reduction should be applied towards the requirements for the Rate of Progress plan. The reductions were calculated as follows:

Percent Reduction (R): 25%
Default Rule Effectiveness (RE): 80%
$Creditable\ \mathrm{Re}ductions = R \times RE = 25\% \times 80\% = 20\%$

Projected VOC emissions of 33 tpsd were taken from the 1996 uncontrolled area source inventory. When the 20% reduction factor is applied, as shown in the above equation, 7 tpsd of creditable VOC reduction is achieved.

7.2.3 Highway Vehicle Source Controls

7.2.3.1 The Federal Motor Vehicle Control Program (FMVCP) and Tier I Vehicle Emissions Standards

Background:

The CAA requires new federal motor vehicle emissions standards, called "Tier I Standards," to be phased in beginning in the 1994 model year. This program is being implemented by the federal government and affects light-duty vehicles and trucks.

This program requires more stringent exhaust emission standards as well as a uniform level of evaporative emission controls, demonstrated through the new federal evaporative test procedures.

Implementation:

This is a federally-implemented measure.

Target Reductions:

Emissions reductions from this program are estimated to be 7 tpsd of VOCs and 15 tpsd of NO_x. The Mobile 5a version H model automatically applies these controls.

7.2.3.2 Enhanced Vehicle Inspection and Maintenance (I/M)

Background:

This measure involves implementing an enhanced vehicle inspection and maintenance (I/M) program, with requirements stricter than the program which has been in place since 1984. The concept behind I/M is to ensure that cars are properly maintained in customer use. Today's cars are dependent on properly functioning emission controls to keep pollution levels low. Minor malfunctions in the emission control system can increase emissions significantly, while major malfunctions can cause emissions to skyrocket. However, malfunctions are often not obvious to the driver. Therefore, a program which requires light-duty vehicles to be inspected periodically and, if necessary, repaired, can greatly reduce vehicle emissions.

The Clean Air Act Amendments of 1990 required the Commonwealth to implement an enhanced I/M program. Subsequently, in December 1995, Congress enacted the National Highway Systems Designation Act (NHS) which provided the opportunity for states to redesign their I/M programs and submit them to EPA by March 26, 1996. Once granted interim approval, states would then have 18 months to begin their programs and prove their effectiveness based on actual operation of the system. Amendments to the Motor Vehicle Code (Act 72), enacted December 15, 1995, provide the Commonwealth with the legislative authority to implement the decentralized test and repair program. Pennsylvania made its NHS submission on March 22, 1996 and received interim conditional approval on January 28, 1997.

Implementation:

The Commonwealth implemented a customer-friendly decentralized program on October 1, 1997, which will meet EPA's high enhanced I/M standard. Annual inspections are conducted at service stations or dealers by certified inspectors in conjunction with the safety inspection. Vehicles to be tested include gasoline-fueled cars and trucks of model year 1975 or newer which are 9,000 pounds or under. Some vehicles, such as antiques, classics and vehicles driven less than 5,000 miles per year, are exempt. All testing facilities will be certified by the Commonwealth.

Substantially more sophisticated testing equipment is being used. System enhancements will significantly improve inspection station and motorist compliance. A safety inspection sticker cannot be issued to affected vehicles until the vehicle receives an emission sticker. Data system enhancements at the inspection stations improve the timeliness of data collection to enable the Commonwealth to determine problem stations and identify potential candidates for additional audits. Hands-on training for inspection and repair technicians with a continuing education component is being provided. Since the program's emphasis is on effective repair, a certification program for repair technicians (in addition to inspectors) has been established.

The program started in the five-county area on October 1, 1997. An official notice of program start was published in the *Pennsylvania Bulletin* on July 26, 1997.

Target Reductions:

Using EPA's Mobile 5a version H model, with inputs as shown in Appendix V, an emission reduction of 59 tpsd VOC and 32 tpsd NO_x (44 tpsd of VOC-equivalent reductions) will be achieved.

7.2.3.3 Reformulated Gasoline

Background:

This program requires the use of lower-polluting reformulated gasoline in the Philadelphia Interstate Ozone Nonattainment Area. This will affect all gasoline-powered vehicles and will also reduce evaporative emissions from service stations.

At a minimum, Phase I reformulated gasoline (available from January 1, 1995 through December 31, 1999) must not cause an increase in NO_x emissions, have an oxygen content of at least 2.0 percent by weight, have a benzene content no greater than 1.0 percent by volume, contain no heavy metals, and contain detergents. Most importantly, the Act requires a reduction in VOC and toxic emissions of 15 percent over baseline levels beginning in 1995 and 25 percent beginning in the year 2000.

Implementation:

This is a federally-implemented measure. This program began on January 1, 1995.

Target Reductions:

Use of reformulated gasoline is expected to reduce VOC emissions by 22 tons per day in the Philadelphia Interstate Ozone Nonattainment Area for highway vehicles and less than 1 tpsd NO_x (less than 1 tpsd of VOC-equivalent reductions). EPA's Mobile 5a version H model is used to project these reductions.

7.3 The 1999 Projected Inventory, Controlled

When the reductions achieved through implementation of the programs described in Section 7.2 are applied, the result is the 1999 Projected Controlled Inventory for VOC and NOx. The following table summarizes the changes in rounded tpsd (some discrepancies may exist due to rounding).

Table 23 – 1999 Inventory Summary

VOC Inventory			
	1999 Uncontrolled	*1999 Controlled*	*Total Reductions*
Point Sources	163	134	29
Area Sources	203	156	47
Nonroad Sources	83	83	0
Highway Vehicles	177	88	89
TOTAL	**625**	**461**	**164**
NO_x Inventory			
	1999 Uncontrolled	*1999 Controlled*	*Total Reductions*
Point Sources	178	143	35
Area Sources	47	47	0
Nonroad Sources	74	74	0
Highway Vehicles	156	109	48
TOTAL	**455**	**373**	**82**

7.4 Transportation Conformity

The CAA (Section 176c) requires that emissions resulting from federally-funded or approved highway and transit plans, programs, and projects may not cause new air quality violations, worsen existing violations, or delay timely attainment of the national air quality standards. EPA has promulgated regulations (40 CFR Part 51.390 and Part 93.100-128) which set forth procedures to determine that transportation plans, programs, and projects "conform" to SIPs. In November 1994, Pennsylvania submitted a revision to its SIP which implemented transportation conformity in the affected areas of the Commonwealth, including the five-county Philadelphia ozone non-attainment area. In practice, the rule is implemented by metropolitan planning organizations (MPOs), who must make a conformity determination before approving certain transportation plans, programs, and projects. The MPO for the five-county Philadelphia area is the Delaware Valley Regional Planning Commission.

EPA's transportation conformity rule provides that the highway vehicle emission "budgets" establish caps on motor vehicle-related emissions which cannot be exceeded by the predicted transportation system emissions in the future. Motor vehicle emission budgets are the emissions from highway vehicles after anticipated controls for a milestone year. EPA's regulations provide that emissions inventories submitted with a control strategy SIP (such as this ROP plan) may establish a budget for conformity purposes even before the SIP itself is approved by EPA.

The highway vehicle portion of the emission inventory is used as the standard against which conformity of the plans, programs, and projects must be measured. The emission budgets established by this document are based on the following projections:

	1990	1999
Vehicle Miles Traveled	64,602,389	74,749,703
Speed	25.2	23.9

The motor vehicle emission budgets for the milestone year (1999) are shown in Table 24. The budgets are shown in tons and kilograms, because while SIP inventories are indicated in tons, transportation conformity projections have traditionally been projected in kilograms.

Table 24 -- Motor Vehicle Emission Budgets for Transportation Conformity

POLLUTANT	1999
VOC - tons per summer day	88
- kilograms per summer day	80,056
NO_x - tons per summer day	109
- kilograms per summer day	98,739

The following information is available in Appendix V to document establishment of the highway vehicle emissions inventories and the transportation conformity emission budgets:

- Vehicle emission inspection/maintenance program modeling parameters
- Summary tables by county: VMT; speed; VOC and NO_x emissions for baseline, adjusted baseline, and control strategy inventories
- Control strategy emission component breakouts by county
- 1990 and 1999 emissions by road functional class – uncontrolled and control strategy
- 1999 emissions by county by vehicle type – uncontrolled and control strategy
- Sample Mobile 5a_h input files
- Sample Mobile 5a_h output files

8. Contingency Measures and Activities

8.1 Background:

States are required to have specific contingency measures that will take effect with minimal further action by the state or EPA if the state fails to reduce VOC emissions in the Philadelphia non-attainment area by nine percent on or before November 15, 1999.

The contingency measures identified by the state must be sufficient to secure an additional three percent reduction in ozone precursor emissions in the year following the year in which the failure has been identified. If the shortfall is less than three percent, a contingency measure need only cover that smaller percentage. If the shortfall is greater than three percent, the state, in an annual tracking report, must either identify the additional actions it will take to cure the shortfall before the next milestone or maintain a reserve of contingency measures capable of covering a shortfall greater than three percent. Early implementation of an emission reduction measure to be carried out in the future is acceptable as a contingency measure.

Reductions for contingency measures can come from either VOC control measures or NO_x control measures that are *not* mandated by the CAA. The NO_x reductions must be adjusted according to the VOC/NO_x ratio calculated on page 50.

This contingency plan is required to show measures sufficient to obtain a reduction of 17 tpsd of VOC, or a combination of VOC and NO_x controls showing equivalent reductions. This ROP plan shows total reductions in excess of the required reductions of 189 tpsd; 18 tpsd of VOC reductions and 2 tpsd VOC-equivalent NO_x reductions from non-CAA mandated programs will be applied toward the required contingency measures, while reductions from implemented measures required by the CAA which exceed the three percent contingency measure requirement will be used to meet the annual post-1999 Rate of Progress reduction requirements.

8.2 Measures

8.2.1. Source and Process Shutdowns

Background:

Several sources which were operational in 1990 and were included in the baseline inventory have since shutdown.

Some of those sources did not apply to bank emission reduction credits (ERCs) generated as a result of the shutdown within the regulatory deadlines established in 25 Pa. Code § 127.207(2). Therefore, the reductions created can be credited as permanent and enforceable emissions decreases.

In addition, Pennsylvania regulations require a 1.3:1 offset ratio for banked emissions. That means that sources who have banked emissions under the provisions of 25 Pa. Code 127(E) may use no more than 77% of these emissions at a later date. The remaining 23% are permanent reductions. When emissions are banked, the table below reflects only the allowable 23% reduction.

Table 25 lists the reduction generated from source or process shutdowns, and their status as banked or unbanked. This results in VOC emission reductions of 2 tpsd and NO_x emission reductions of 1 tpsd. An example calculation of credits is on the following page.

Table 25 – Source and Process Shutdowns

Company	County	NEDS ID	Banked Status	1999 Reductions - tpsd
VOC Shutdowns				
Rohm & Haas Delaware	Bucks	0009	Yes	0.02
US Steel Corp	Bucks	0055	Yes	0.00
Sun Refining & Marketing	Delaware	0025	Yes	0.04
BP Oil, Inc	Delaware	0030	Yes	0.05
Congoleum Corp	Delaware	0049	Yes	0.20
Sun Refining & Marketing	Philadelphia	1501	Yes	0.04
Rohm & Haas - Delaware	Philadelphia	1531	Yes	0.05
Allied Chemical Corp	Philadelphia	1551	Yes	0.65
Crown Cork & Seal	Philadelphia	1555	Yes	0.21
Progress Lighting Co	Philadelphia	1584	Yes	0.01
Acme Markets	Philadelphia	2002	No	0.05
SKF Ind	Philadelphia	2067	No	0.26
Schneider Bros Co	Philadelphia	3292	No	0.15
Monarch MFG Works Inc	Philadelphia	3492	No	0.08
Craft-Bilt Co	Philadelphia	3551	No	0.15
Container Recyclers	Philadelphia	5112	No	0.10
Quality Container Company	Philadelphia	5116	No	0.13
US Naval Base	Philadelphia	9702	No	0.12
US Mint	Philadelphia	9703	No	0.07
TOTAL:				**2.38**
NO_x Shutdowns				
US Steel Corp	Bucks	0055	Yes	1.22
Sun Refining & Marketing	Delaware	0025	Yes	0.25
TOTAL:				**1.47**

A sample calculation of source or process shutdown credits follows:

BP Oil Company
AFS County Number: 045
NEDS ID: 0030
Source Number: 104
1990 days per year (dpy) of operation: 365 dpy
1990 tons per day (tpd) of VOC emissions: 1.94 tpd
Emission reductions claimed: 83 tpy VOC
1996 growth factor: 1.0022
1999 growth factor: 1.0048

Emission reductions/1990 dpy =
83 tpy/365 dpy = 0.23 tpd

23% creditable emission reduction =
(0.23 tpd)(0.23) = 0.05 tpd emission reduction

1990 tpd * 1996 growth =
(1.94 tpd)(1.0022) = 1.95 tpd 1996 projected

tpd 1996 projected - tpd emission reduction =
1.95 - 0.05 = 1.90 tpd 1996 projected with emission reduction

Note : Future emissions for this source (#104) are frozen at or below this level - 1.90 tpd VOC.

1990 tpd * 1999 growth =
(1.94)(1.0048) = 1.95 tpd 1999 projected

tpd 1999 projected - tpd 1996 projected with emission reduction =
1.95 - 1.90 = 0.05 tpd reduction for 1999.

The result of this example calculation is that the creditable emission reduction for 1999 for source #104 (BP Oil) is <u>0.05 tpd</u>, as noted in Table 21.

All other facilities' creditable reductions are calculated in a similar manner. Please note that for this example, all emission numbers were rounded to two decimal places. Actual calculations are performed with four decimal places included, so some discrepancies due to rounding may be present in the above example.

8.2.2. Rule Effectiveness

Background:

This activity involves enhancing rule compliance by improving the implementation or enforcement of an existing rule which is already part of the SIP. Pennsylvania, in accordance with EPA guidance, applies a default 80 percent rule effectiveness (RE) to sources with control devices which cannot quantify their emissions through direct determination methods.

The projected emission reductions, listed in *Table 26*, are based on a 10 percent increase in RE from 80 to 90 percent. The amount of creditable reductions identified in this plan were calculated by applying this 10 percent improvement to the sources specified in Table 26 at their controlled emission levels. The 10 percent improvement credited is a conservative estimate – improvements well in excess of 10 percent are possible through the initiatives the sources are putting in place.

To estimate creditable emission reductions from RE improvements, state and local agencies require a method to quantify the predicted RE increase. The methodology must determine the impact of specific improvement activities available to a state or local agency. In order to predict the effectiveness of RE improvement activities, EPA's Ozone/Carbon Monoxide Programs branch developed an RE matrix. The matrix is used to develop creditable emission reductions based on a questionnaire that EPA used to estimate base rule effectiveness for source categories. The following principles guided the development of the matrix:

- All state and local agencies should be guaranteed at least 80% base RE;
- State and local agencies with an RE well above the 80% default should receive more emission reduction credit for an RE improvement;
- RE improvements should be documented in a permit or in a SIP;
- 100 percent RE is achieved in cases of direct determinations of emissions or elimination of VOCs or other pollutants through an irreversible process.

The matrix is divided into thirteen categories representing the range of activities and conditions that influence rule effectiveness. The 13 categories are:

- Training of Plant Operators
- Inspector Training
- Educational Opportunities for Source
- Procedures for Operation and Maintenance
- Clarity of Testing Procedures and Schedules
- Rule Effectiveness Evaluation Program
- Monitoring
- Type of Inspection

- Administrative Authority - Prison
- Administrative Authority - Fines
- Administrative Authority - Citations
- Media Publication of Enforcement Actions
- Follow-up Inspections

The matrix includes subcategories for six of these categories. Activities which are the most specific in the matrix are arranged in descending order with the first activity having the most significant impact on RE.

Implementation:

In order to achieve creditable reductions from RE, the Department must design and implement an acceptable plan. The plan, outlined below, contains the selected matrix activities to be implemented at appropriate sources. Calculations using the planned activities indicate an average RE of over 94 percent.

The matrix activities listed in the plan were implemented and are currently in place at the affected facilities (see Table 26). This included changes to Department procedures, plans, and work practices and the incorporation of activities through appropriate permit revisions at the identified sources.

The following is an outline of the RE improvement plan:

1. Select matrix activities and identify affected sources.
2. Plan development. Several meetings were held with the regional staff in order to develop the plan. The regional operations staff (field inspectors) was provided with background on RE and the proposed plan. Matrix activities were selected in a collaborative effort. Affected sources were contacted to ensure feasibility of implementing those activities which would affect them directly.
3. Implement matrix activities. Activities were added to permits, Department work plans, and Title V facility permits where applicable. Proper documentation practices are incorporated into training and operating plans.
4. Single Source Category Determination (SSCD). Facility and records inspections completed in September, 1997.

RE Improvement Activities:
Selected activities for upgrade actions as contained in the EPA's matrix.

1. ***Facility Activities*** - to be added to permit conditions. *(will affect 100% of plant emissions)*:

  A. Training of plant operators
    a) Require formal operator introductory operator training course of 41-80 hours.

b) Require operators to take annual refresher training annually of 25-40 hours.

c) Require appraisal and update of training program every 4 or more years.

B. Procedures for operation and maintenance of control and/or process equipment.

a) Have equipment operators follow and sign daily Operation and Maintenance instructions.

C. Monitoring.

a) Require source-specific enhanced monitoring procedures with a detailed self-evaluation schedule and use these data for compliance purposes.

b) Enhanced monitoring records filed with agency every 4-6 months.

2. Department Activities:

A. Inspector Training

a) Formal inspector introductory courses, more than 80 hours.

b) Receive source-specific, inspector-refresher course with annual hours averaging 41-80 hours.

c) Frequency with which appraisal and update training program is held for inspectors, every six months to a year.

B. Rule Effectiveness Evaluation Program

a) Highest level category specific rule monitoring and evaluation, SSCD protocol study.

b) Highest level of follow-up from rule monitoring and evaluation, rule corrections made based on SSCD protocol study result.

3. Potential additional activities - not included in preliminary calculation or plan:

A. Clarity of testing procedures and schedules

a) Specific guidelines on testing and test method requirements and frequency schedule.

B. Educational opportunities for sources

a) Frequency in years of workshops held by regulatory authority for industry on regulatory requirements, every year to two years.

b) Frequency in years with which information packages on regulatory requirements are sent by the regulatory authority to sources, every year to two years.

C. Types of Inspection

a) Level 3: detailed engineering analysis of process parameters, internal inspection of process and/or control devices.

Target Reductions:

Calculation of Projected Improved RE

The following calculations are done in accordance with EPA manual 452/R-94-001, *Rule Effectiveness Guidance: Integration of Inventory, Compliance, and Assessment Applications*, Pages 4-10, section 4.5. The matrix equation/methodology calculation provides a number representing the increase in RE.

Definitions:

The Rule Effectiveness Raw Score (RERS) is defined as:

$$RERS = \sum_{G=1}^{n} \{G(x_s) \sum_{F=1}^{m} [F(t,G(x_s),f)] - [F(t,G(x_s),o) \times y(t,o)]\}$$

Where:

$G(x_s)$	= Weight assigned to sub-category s of matrix category x
$F(t,G(x_s))$	= Weight assigned to activity t of sub-category s
$F(t,G(x_s),o)$	= Value of activity t of sub-category s *before* RE improvement is implemented
$F(t,G(x_s),f)$	= Value of activity t of sub-category s *after* RE improvement is implemented
$y(t,o)$	= Emissions corresponding to facilities implementing activity t as a % of the total emissions from a source category *before* improvement is implemented, where applicable, or 1
$z(t,f)$	= Emissions corresponding to facilities implementing activity t as a % of the total emissions from a source category *after* improvement is implemented, where applicable, or 1

Example:

$G(A_1) = 9$
$F(e(A_1)) = 1$
$F(b(A_1)) = 8$
$F(e(A_1),o) = F(e(A_1)) \times 100\% = 1$
$F(e,b(A_1),f) = [F(b(A_1) \times 100\%)] + [F(e)(A_1) \times 0\%] = 8$
$F(e,b\,(A_1),f) - F(e(A_1),o) = 8 - 1 = 7$

Using the RERS equation, the value to be summed with the other activities is:
$7 \times G(A_1) = 63.$

Similarly,
$G(A_2) = 28$
$G(A_3) = 7$
$G(B_1) = 81$
$G(B_2) = 42$

$G(B_3) = 30$
$G(C_1) = 6$
$G(C_2) = 6$
$G(D) = 180$
$G(E) = 153$
$G(F_1) = 36$
$G(F_2) = 36$
$G(G_1) = 135$
$G(G_2) = 80$
$G(H) = 147$
$G(I) = 56$
$G(J_1) = 48$
$G(J_2) = 36$
$G(K) = 99$
$G(L) = 0$
$\underline{G(M) = 0}$
RERS = 1269

RE(o) = 80%
RERS = 1269
RERS(max) = 1818

RE(i) = (100% - 80%) × (1269/1818) = 14.0%

RE(f) = 80% + 14.0% = 94.0%

Calculation of the emission reduction should use the formula (4) on page 4-6 of the EPA guidance manual. However, it is in error (see Memo from John Silvasi for explanation). The correct method requires that the inventory method of calculating RE be used for RE_o and RE_f. Therefore, the Department used the RE emissions calculation method from page 3-5, section 3.1.3.3 "Applying RE" which stated that:

RE emissions = Uncontrolled emissions × (1-(CE/100 × RE/100)

The reduction is thus equal to:

(RE_f emissions at 90% RE) – (RE_o emissions at 80% RE)

Each facility's emissions were calculated using its permitted control efficiency and a 90% RE. The calculations resulted in VOC emission reductions of 16 tpsd. Table 26 lists the affected facilities and each one's associated reduction.

Sample Calculation:
Source ID# 22-19035180

$$RE_o\text{-}Emissions = 0.4 \times (1 - \left(\frac{95}{100} \times \frac{80}{100}\right)) = 0.10$$

$$RE_f\ Emissions = 0.4 \times (1 - \left(\frac{95}{100} \times \frac{90}{100}\right)) = 0.06$$

RE Emissions = RE_o - RE_f = 0.10-0.06 = 0.04

Table 26 – Rule Effectiveness Facilities

Company	County	1999 Reductions - tpsd
Pre Finish Metals, Inc.	Bucks	0.39
Paramount Packaging	Bucks	0.25
Cleveland Steel Container	Bucks	0.01
Dunmore Corporation	Bucks	0.11
NVF Co.	Chester	1.47
Reynolds Metals Co.	Chester	0.18
Congoleum Corp.	Delaware	12.45
Brown Printing Co.	Montgomery	0.10
Allied Chemical Corp.	Philadelphia	0.31
Kurz-Hastings Inc.	Philadelphia	0.66
TOTALS:		**15.93**